Allen-Bradley

ControlLogix Redundancy System

1756-CNB/D/E, 1756-CNBR/D/E, 1756-ENBT, 1756-EWEB, 1756-L55, 1756-L55M12, 1756-L55M13, 1756-L55M14, 1756-L55M16, 1756-L55M22, 1756-L55M23, 1756-L55M24, 1756-L61, 1756-L62, 1756-L63, 1757-SRM

User Manual

Rockwell Automation

Important User Information

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WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD	Labels may be located on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
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Introduction

This release of this document contains new and updated information. To find new and updated information, look for change bars, as shown next to this paragraph.

Updated Information

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Compatible Software Versions	26
Enhancements in Revision 15.56	26
Corrected Anomalies in Revision 15.56	27
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Purpose of this Manual

This manual guides the design, development, and implementation of a redundancy system for a ControlLogix controller.

Who Should Use this Manual

This manual is intended for those in the following professions who design and develop applications that use ControlLogix controllers:

- Software engineers
- Control engineers
- Application engineers
- Instrumentation technicians

When to Use This Manual

Use this manual throughout the lifecycle of a redundancy system. The lifecycle consists of the following stages:

- Design
- Installation
- Configuration
- Programming
- Testing
- Maintenance and troubleshooting

How to Use this Manual

This manual is divided into the basic tasks performed during the design, development, and implementation of a ControlLogix redundancy system.

- Each chapter covers a task.
- Tasks are organized in the sequence you will typically perform them.

In this manual, some text is formatted differently.

Text That Is	Identifies	For Example	Means
Italic	The actual name of an item that you see on your screen or in an example	Right-click *User-Defined* ...	Right-click on the item that is named User-Defined.
`Courier`	Information that you must supply based on your application (a variable).	Right-click `name_of_program` ...	You must identify the specific program in your application. Typically, it is a name or variable that you have defined.
Enclosed in brackets	A keyboard key.	Press [Enter].	Press the Enter key.

Related Documentation

This table lists ControlLogix products and documentation that may be valuable as in programming an application.

Catalog Number	Title	Publication Number
1756-CNB/D and 1756-CNBR/D	ControlLogix ControlNet Bridge Module Installation Instructions	1756-IN571B
	ControlLogix ControlNet Interface Module Release Notes	1756-RN587H
1756-CNB/E and 1756-CNBR/E	ControlLogix ControlNet Bridge Module, Series E Installation Instructions	1756-IN604A
	ControlLogix ControlNet Bridge Module, Series E Release Notes	1756-RN627C
1756-ENBT/A	1756 10/100Mbps EtherNet/IP Bridge, Twisted Pair Media Release Notes	1756-RN602A
1756-ENBT	1756-ENBT ControlLogix EtherNet/IP Product Profile	1756-PP004A
	ControlLogix EtherNet/IP Bridge Module Installation Instructions	1756-IN019C
	ControlLogix EtherNet/IP Communication Release Notes	1756-RN591N
1756-EWEB	1756-EWEB EtherNet/IP Web Server Module Release Notes	1756-RN604E
	EtherNet/IP Web Server Module Installation Instructions	1756-IN588A
	EtherNet/IP Web Server Module User Manual	ENET-UM527D
1756-L55	ControlLogix Controller and Memory Board Installation Instructions	1756-IN101K
1756-L61	ControlLogix Controller and Memory Board Installation Instructions	1756-IN101K
1756-L62		
1756-L63		
1756-M12		
1756-M13		
1756-M14		
1756-M16		
1756-M22		
1756-M23		
1756-M24		
1757-SRM/B	ProcessLogix/ControlLogix System Redundancy Module Installation Instructions	1757-IN092D

ControlLogix Redundancy Overview

What's in This Chapter?

This chapter provides an overview of the ControlLogix redundancy system, including commonly used terms. It also answers some common questions about a ControlLogix redundancy system.

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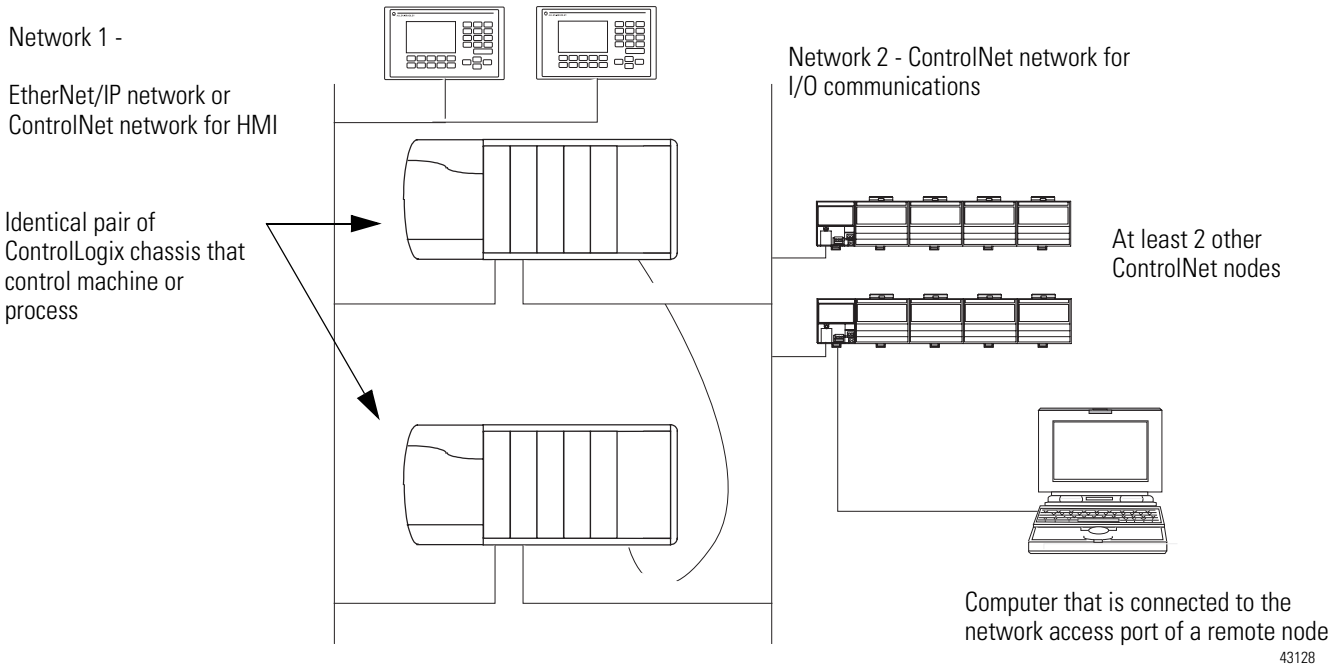
What Are The Main Parts of a Redundant System?

The ControlLogix redundancy system uses an identical pair of ControlLogix chassis to keep a machine or process running if a problem occurs with a controller.

The following diagram shows the layout of a simple redundant setup.



What Firmware Combinations Make Up a Redundant System?

The following firmware combinations make up revision 15.56 of the ControlLogix redundancy system:

Module	Catalog Number	Series	Firmware Revision
ControlLogix5555 controller	1756-L55Mxx	Any	15.56
ControlLogix5561 controller	1756-L61	Any	15.56
ControlLogix5562 controller	1756-L62	Any	15.56
ControlLogix5563 controller	1756-L63	Any	15.56
ControlNet bridge module	1756-CNB 1756-CNBR	D	7.12
		E	11.1
1756 10/100 Mbps EtherNet/IP Bridge, Twisted Pair Media	1756-ENBT	Any	4.3
1756 10/100 Mbps EtherNet/IP Bridge w/ Enhanced Web Services	1756-EWEB	Any	4.3
Redundancy module	1757-SRM	Any	4.3

What Are the Important Terms in a Redundant System?

Redundancy requires no additional programming and is transparent to any devices connected over an EtherNet/IP or ControlNet network. Redundancy uses 1757-SRM modules to maintain communication between the pair of redundant chassis.

In a redundant system, the following terms describe the relationship between the two redundant chassis:

Term	Description
Primary Controller	The controller that is currently controlling the machine or process.
Primary Chassis	The chassis that contains the primary controller or controllers.
Secondary Controller	The controller that is standing by to take control of the machine or process. A secondary controller always resides in a different chassis than the primary controller.
Secondary Chassis	The chassis that contains the secondary controller or controllers.
Switchover	Transfer of control from the primary controller to the secondary controller. After a switchover, the controller that takes control becomes the primary controller. Its partner controller (the controller that was previously the primary controller) becomes the secondary controller.

How Do I Assign the Primary Chassis?

In a pair of redundant chassis, the first chassis turned on becomes the primary chassis. When to the secondary chassis receives power, it chassis synchronizes itself with the primary chassis.

What Causes a Switch from One Controller to Another?

When primary chassis components fail, control switches to the secondary controller. A switchover occurs for any of the following reasons:

- any of the following situations in the primary chassis:
  - loss of power
  - major fault of the controller
  - removal, insertion, or failure of any module in the primary chassis
  - break or disconnection of a ControlNet tap or ethernet cable
- command from the primary controller
- command from RSLinx software

Can I Use a Network Access Port?

To connect a device to the network access port (NAP) of a 1756-CNB/D/E or 1756-CNBR/D/E module, use an NAP that is outside of a redundant chassis.

IMPORTANT

Use of the Network Access Port (NAP)

Do not connect any device to the network access port (NAP) of a 1756-CNB/D/E or -CNBR/D/E module in a redundant chassis.

- If you connect a device to the NAP of a CNB module in a redundant chassis, a switchover will fail to occur if the CNB module is disconnected from the network. While the CNB module is disconnected from the network, the controller will be unable to control any I/O devices through that CNB module.
- If you connect a workstation to the NAP of a CNB module in a redundant chassis, the workstation will be unable to go online after a switchover.

To connect a device to a ControlNet network via a NAP, use a NAP that is outside of a redundant chassis.

Do I See a Bump in Outputs During a Switchover?

Depending on how you organize your RSLogix 5000 project, outputs may or may not experience a change in state (bump) during a switchover.

- During the switchover, outputs controlled by the highest priority task experience a bump-free switchover. For example, outputs don't revert to a previous state.
- Outputs in lower priority tasks may experience a change of state.

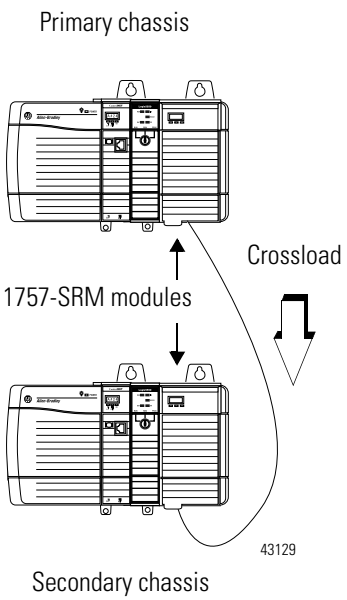
The switchover time of a redundant system depends on the type of failure and the network update time (NUT) of the ControlNet network. For a NUT of 10 ms, the switchover time is approximately 80 ms to 220 ms.

How Does the Second Controller Stay Up to Date?

To take over control, the secondary controller requires the same project as the primary controller. It also requires up-to-date tag values.

The following terms describe the process of communication between the two controllers.

Term	Description
CrossloadC	The transfer of any or all of the contents of the primary controller to the secondary controller. This could be updated tag values, force values, online edits, or any other information about the project. A crossload happens initially when the chassis synchronize and then repeatedly as the primary controller executes its logic.
Synchronize	The process that readies a secondary chassis to take over control if a failure occurs in the primary chassis. During synchronization, the 1757-SRM modules check that the partner modules in the redundant chassis pair are compatible with each other. The SRM modules also provide the path for crossloading (transferring) the content of the primary controller to the secondary controller. Synchronization occurs when power is applied to the secondary chassis and after a switchover is diagnosed and fixed.
Synchronized	The secondary chassis is ready to assume control if the primary chassis fails.
Disqualified	The secondary chassis isn't synchronized with the primary chassis. If a secondary chassis is disqualified, it can't take over control of the machine or process. A secondary chassis can be manually disqualified.
Qualify	Same as synchronize
Qualified	Same as synchronized



The 1757-SRM modules keep communication between the primary and secondary chassis.

- Don't download the project to the secondary controller. While the secondary controller is synchronizing with the primary controller, the 1757-SRM modules automatically let the primary controller transfer the project to the secondary controller.
- Once the secondary controller is synchronized, the 1757-SRM modules keep the controller synchronized by providing the path for crossloading any changes that occur in the primary controller. These changes include:
  - online edits.
  - force values.
  - changes to properties.
  - changes to data.
  - results of logic execution.

What If I Make Online Edits?

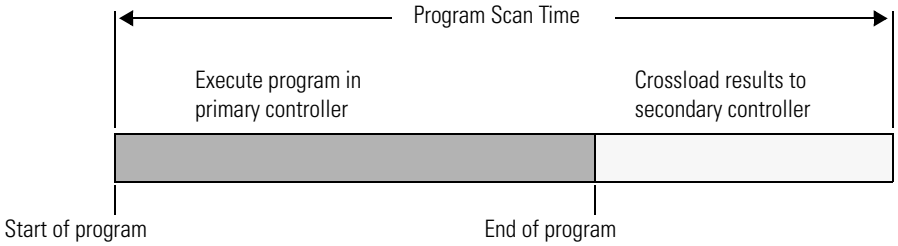
Online edits automatically crossload to the secondary controller. They become inactive if a switchover happens before you assemble them into the project. This stops a mistake from faulting both the old and new primary controllers.

Suppose you test an online edit and it causes the controller to fault. In that case, a switchover happens. The new primary controller automatically untests the edits and goes back to the original code.

You have the option to keep the edits active after a switchover (at the risk of faulting both controllers).

Does My Scan Time Increase?

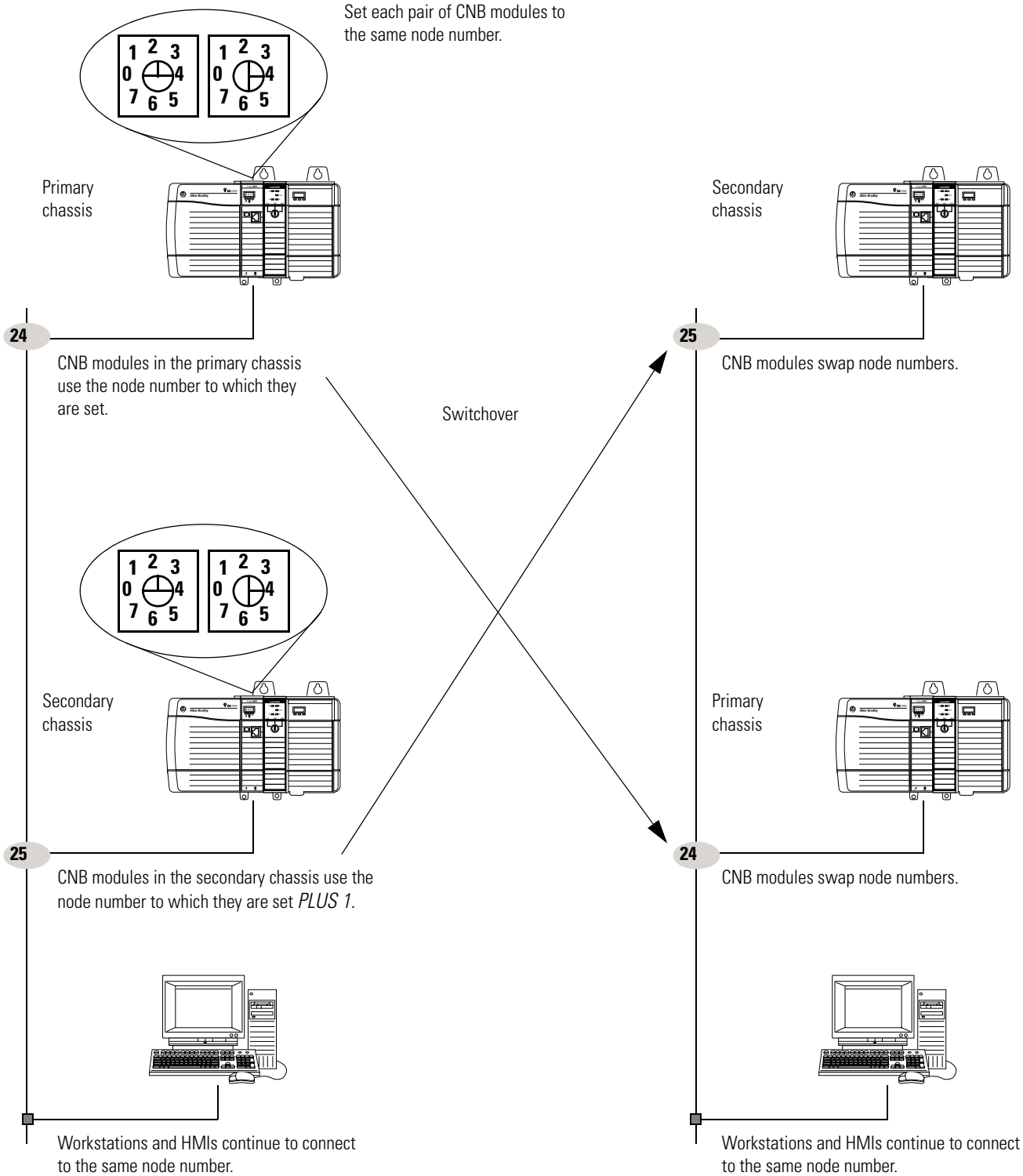
At the end of each program, the primary controller pauses its execution to crossload the result of any output instruction that executed in the program. This results in an increased program scan time for a synchronized redundancy system.



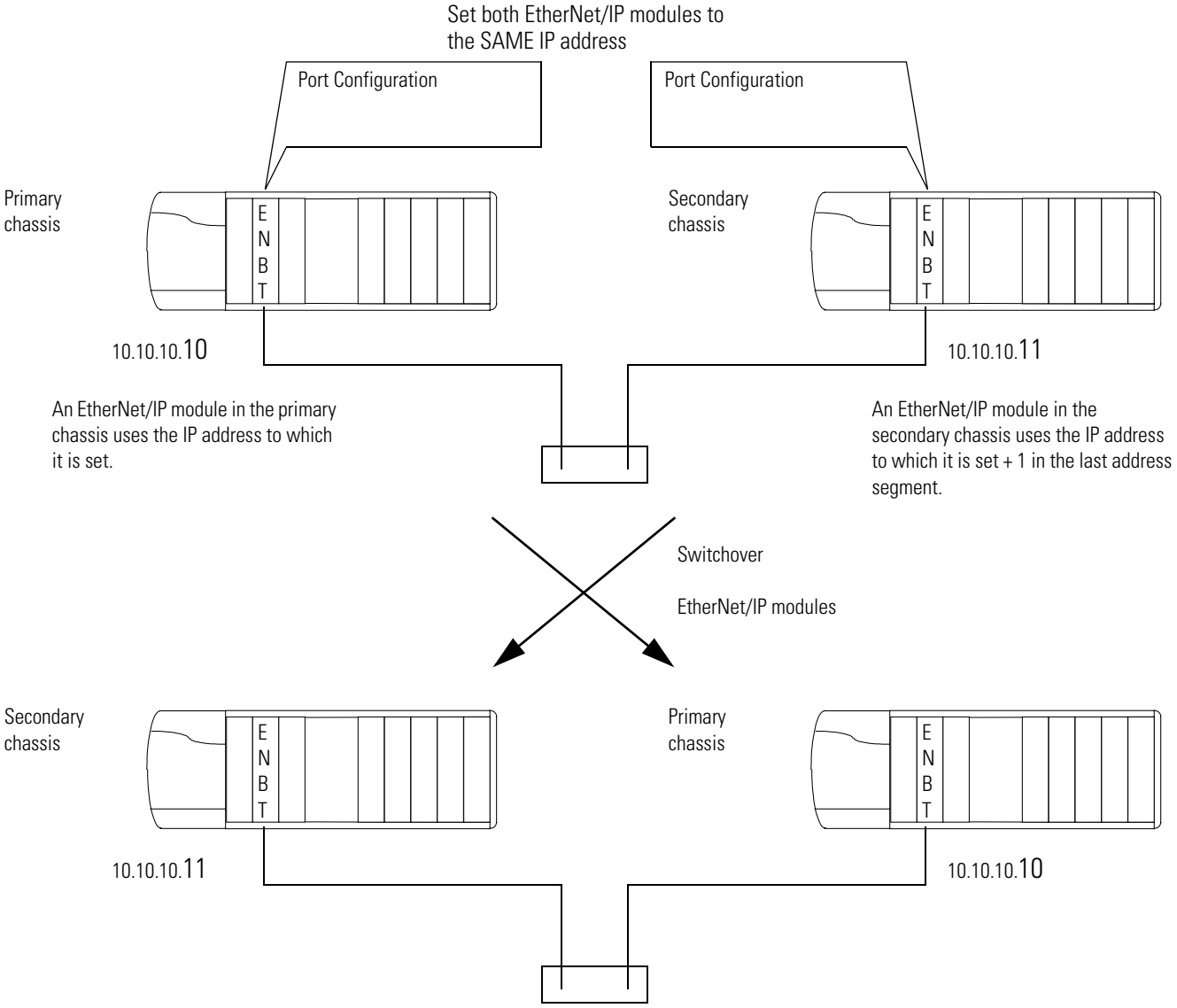
What Happens to Network Addresses During a Switchover?

Each CNB, ENBT, or EWEB module in a redundant chassis shares a pair of network addresses with its partner in the other chassis.

If You Have a ControlNet Network


Set each pair of CNB modules to the same node number.
Primary chassis
Secondary chassis
24
25
CNB modules in the primary chassis use the node number to which they are set.
Switchover
CNB modules swap node numbers.
Secondary chassis
Primary chassis
25
24
CNB modules in the secondary chassis use the node number to which they are set *PLUS 1*.
CNB modules swap node numbers.
Workstations and HMIs continue to connect to the same node number.
Workstations and HMIs continue to connect to the same node number.

If You Have an EtherNet/IP Network


Set both EtherNet/IP modules to the SAME IP address
Port Configuration
Port Configuration
Primary chassis
Secondary chassis
E N B T
E N B T
10.10.10.10
10.10.10.11
An EtherNet/IP module in the primary chassis uses the IP address to which it is set.
An EtherNet/IP module in the secondary chassis uses the IP address to which it is set + 1 in the last address segment.
Switchover
EtherNet/IP modules
Secondary chassis
Primary chassis
E N B T
E N B T
10.10.10.11
10.10.10.10

What Can't I Do with a Redundant System?

Don't use any of these features in a ControlLogix redundancy system:

- local chassis I/O, 1756-DHRIO, or 1756-DNB modules
- event task
- inhibit a task
- data storage on a CompactFlash card via the controller. It's OK to store a project on a CompactFlash card. See page 137.
- motion control, such as the following modules:
  – 1756-HYD02

– 1756-L60M03SE
– 1756-M02AE
– 1756-M02AS
– 1756-M03SE
– 1756-M08SE
– 1756-M16SE

Quick Start Checklists

The following checklists provide a summary of the criteria for a successful ControlLogix redundancy system. See the remaining chapters for more information on each parameter.

System Layout

Parameter	Criteria	Page
1. ControlNet networks	• ControlNet networks are the primary networks for the system. • OK to bridge to devices on other networks, such as DeviceNet, Universal Remote I/O, and DH+ networks. • Networks follow the guidelines in Logix5000 Controllers Design Considerations, publication 1756-RM094.	30, 33

2. I/O Placement	• All I/O modules in remote chassis or DIN rails (no I/O in the local chassis)
	• All I/O in *ONLY* the following locations:
	  • same ControlNet network as the redundant controllers (no bridging)
	  • DeviceNet network (via a 1756-DNB module in a remote chassis)
	  • universal remote I/O network (via a 1756-DHRIO module in a remote chassis)
		30, 33

3. ControlNet network update times	• NUTs ≤90 ms • NUTs ≤specified relationship to each other	37
4. Number of ControlNet nodes	At least 2 nodes on each network in addition to the CNBs in the redundant chassis - For example, each ControlNet network has at least 4 nodes.	37
5. ControlNet node assignments	• Nonredundant nodes use the lowest node numbers • CNB modules in the redundant chassis set close to the SMAX. • 2 consecutive node addresses for each set of partner CNB modules (one in each chassis) • Switches of each partner CNB module set to the same node address	18, 37
6. Network Access Ports	No devices connected to the network access ports of CNB modules in the redundant chassis	30
7. EtherNet/IP networks	EtherNet/IP networks are only for HMIs, workstations, and messaging (no control of I/O). No EtherNet/IP network for: • control of I/O • peer interlocking (produced and consumed tags)	30, 40

Redundant Chassis Configuration

Parameter	Criteria	Page
1. Chassis size	Same size chassis for each pair of redundant chassis.	31

2. Chassis layout	• Only the following modules in each redundant chassis (*NO* other modules):
	  • controllers
	  • ControlNet modules
	  • EtherNet/IP modules
	  • System redundancy module (needs 2 slots)
	• Each chassis within a redundant pair looks the same:
	  • Identical modules (same catalog number, series, revision, and memory size)
	  • Same slot assignments
		31

3. System redundancy modules	1757-SRM module: • 1 in each redundant chassis • Needs 2 slots • Needs 1757-SRCx cable (1, 3, 10, 50, and 100 meter lengths)	31, 32

4. Controllers	ControlLogix5555, ControlLogix5561, ControlLogix5562, or ControlLogix5563 controllers
	• Which type of controller do you want to use?
	  • If ControlLogix5555, then 1 or 2 controllers in *EACH* redundant chassis.
	  • If ControlLogix5561, ControlLogix5562, or ControlLogix5563, then *ONLY* 1 controller in each redundant chassis.
	• Same type of controller throughout the chassis.
	• Enough memory for 2 copies of all data.
	• 7 connections for redundancy
		31

5. ControlNet modules	1756-CNB/D/E or 1756-CNBR/D/E module or modules: • CPU usage ≤75% • CNB modules have the same keeper information • ≤5 CNB modules. See also parameter 6 below.	31, 110, 127

Redundant Chassis Configuration (Continued)

Parameter	Criteria	Page

6. EtherNet/IP modules	1756-ENBT or 1756-EWEB modules:
	• Which modules do you want to use?
	  • If 1756-ENBT, catalog revision greater than or equal to E01 (E01, E02, …, F01). See the label on the side of the module or its box.
	  • If 1756-EWEB, any catalog revision
	• Up to 2 EtherNet/IP modules in each redundant chassis, within these limits:
		31, 40

If you have	Use up to
1 ControlNet module	2 EtherNet/IP modules
2 ControlNet modules	2 EtherNet/IP modules
3 ControlNet modules	2 EtherNet/IP modules
4 ControlNet modules	1 EtherNet/IP module
5 ControlNet modules	No EtherNet/IP modules
Don't use more than 5 ControlNet modules.	

RSLogix 5000 Project

Parameter	Criteria	Page
1. Number of projects	Only one RSLogix 5000 project for the pair of redundant controllers. The project automatically crossloads to the secondary controller when the secondary controller synchronizes with the primary controller.	69
2. Controller properties	• ControlLogix5555, ControlLogix5561, ControlLogix5562, or ControlLogix5563 controller • Redundancy enabled	72
3. Task structure	• Only one task at the highest priority • If more than one task, all tasks periodic	74, 79, 123
4. I/O	• Outputs that require a bumpless switchover are in the highest priority task • Requested packet interval (RPI) less than or equal to 375 milliseconds. (Larger RPIs may produce a bump at switchover.).	74
5. Task watchdog time	Watchdog time ≥ (2 * *maximum_scan_time*) + 100 ms where: *Maximum_scan_time* is the maximum scan time for the entire task when the secondary controller is synchronized.	102

RSLogix 5000 Project (Continued)

Parameter	Criteria	Page
6. Minimizing scan time	• A few large programs instead of a lot of small programs • No unused tags • Arrays and user-defined data types instead of individual tags • User-defined data types as compact as possible • Code as compact as possible • Code runs only when you need it • Data grouped by how often you need it • DINT tags instead of SINT or INT tags	79
7. Data integrity	Special treatment for: • Bit Shift Left (BSL) and Bit Shift Right (BSR) instructions • FIFO Unload (FFU) instructions • Logic that is scan dependent	85
8. Produced and consumed tags	If you want a controller in another chassis to consume a tag from the redundant controller, use a comm format of None. In the I/O configuration of the consuming controller, select a comm format of None for the remote CNB module (the CNB that is physically in the redundant chassis).	74
9. Message (MSG) instructions	For any MSG instruction from a controller in another chassis to a redundant controller, cache the connection.	74

Operator Interface Terminals

<table>
<tr><th>Parameter</th><th>For any of these operator interfaces</th><th>Criteria</th><th>Page</th></tr>
<tr><td rowspan="4">1. EtherNet/IP network</td><td>PanelView Standard terminal</td><td>Same as a nonredundant system</td><td rowspan="4">30, 34, 40</td></tr>
<tr><td>• PanelView Plus terminal
• VersaView industrial computer running a Windows CE operating system</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Set aside connections for EACH PanelView Plus or VersaView CE terminal:
<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr><tr><td>ENBT</td><td>5 connections</td></tr><tr><td>EWEB</td><td>5 connections</td></tr></table></td></tr>
<tr><td>RSView Supervisory Edition software with RSLinx Enterprise software</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Use IP swapping.
• Keep the HMI and both redundant chassis on the same subnet.</td></tr>
<tr><td>• RSView Supervisory Edition software with RSLinx 2.x software
• RSView 32 software
• Any other HMI client software that uses RSLinx 2.x software</td><td>Limit the number of RSLinx servers that a controller uses to 1 (ideal) to 3 (maximum).</td></tr>
<tr><td rowspan="3">2. ControlNet network</td><td>• PanelView Standard terminal
• PanelView 1000e/1400e terminal</td><td>Do terminals use unscheduled communication?
• Yes — Use ≤4 terminals per controller.
• No — Use the number of terminals that you need.</td><td rowspan="3">30, 34, 37</td></tr>
<tr><td>• PanelView Plus terminal
• VersaView industrial computer running a Windows CE operating system</td><td>Set aside connections for EACH PanelView Plus or VersaView CE terminal:
<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr></table></td></tr>
<tr><td>• RSView Supervisory Edition software
• RSView 32 software
• Any other HMI client software that uses RSLinx 2.x software</td><td>Limit the number of RSLinx servers that a controller uses to 1 (ideal) to 3 (maximum).</td></tr>
</table>

Compatible Software Versions

With version 15.56 of the ControlLogix redundancy system, use any of the following software versions:

For This Software	Use This Version	Notes
RSLinx	2.50	
1757-SRM System Redundancy Module Configuration tool	3.4	**Important**: **Don't** update the SRM Configuration tool at this time. See Update a System That Is Already at Revision 13 on page 142. Get Knowledgebase document G92234770. To access Rockwell Automation's Knowledgebase, go to http://support.rockwellautomation.com
RSLinx Enterprise	3.0	You need this only for these HMIs: PanelView Plus terminal VersaView industrial computer running a Windows CE operating system RSView Supervisory Edition software **Important**: For RSView Supervisory Edition software, install the RSLinx Enterprise HOTFIX. The HOTFIX improves the EtherNet/IP switchover time. See Knowledgebase document R154640079. To access Rockwell Automation's Knowledgebase, go to http://support.rockwellautomation.com
RSLogix 5000	15.01	
RSNetWorx	5.11	

Enhancements to Redundancy Revision 15.56

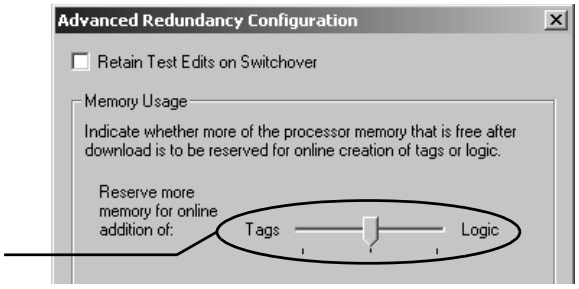
The following enhancements apply to a redundant system using revision 15.56:

Enhancement	Description
Update the firmware of the redundant chassis while the process is running	This revision lets you update the firmware in the redundant chassis without shutting down the process. To do this, the system must be at revision 13.
Add I/O modules while online	At runtime, add 1756 I/O modules to a remote chassis via the unscheduled portion of a ControlNet network.

Corrected Anomalies in Redundancy Revision 15.56

Redundancy revision 15.56 corrects the following anomalies:

Corrected Anomaly	Description
The File Search Compare (FSC) instruction caused an unrecoverable fault	The FSC instruction caused a unrecoverable fault if both these conditions occurred: • major fault declared from within the expression of an FSC instruction • fault cleared by user fault routine Lgx00055522
You couldn't send an SLC typed write message to a redundant controller	An SLC-typed write message to a redundant controller produced error F007. Lgx00058402
Memory changes during prescan weren't always crossloaded	Sometimes the primary controller didn't send data changes that it made during prescan to the secondary controller. Lgx00060517
Some data table write services weren't immediately forwarded to the secondary controller	Data table write, big write, and read-modify-write services weren't immediately forwarded to the secondary controller if the service used a symbolic address. Instead, they were forwarded after the next program scan. Lgx00060643
A secondary SRM faulted with an E888 error if you unplugged a CNB module	The secondary 1757-SRM module sometimes faulted while synchronized if you unplugged the tap to a secondary 1756-CNB module. The error code of the SRM module was E888. This caused the chassis to become disqualified. You had to remove and reinsert the secondary SRM module under power to recover. Lgx00060989
A synchronized chassis pair didn't automatically synchronize after being disqualified	The redundant chassis pair didn't automatically synchronize after multiple cycles of disqualification caused by either unplugging the tap to a secondary 1756-CNB module or power-cycling the secondary chassis. You had to remove and reinsert the secondary SRM module under power to recover. Lgx00061808, Lgx00060991
Sometimes a module faulted after a switchover	Sometimes a module would fault after a broken or disconnected communication cable caused a switchover. The module showed a fault code of 16#0022. Lgx00061990
The SRM pair lost the fiber optic connection under heavy HMI traffic	The synchronized pair of 1757-SRM modules would sometimes lose their connection across the fiber optic link under heavy HMI traffic conditions. This caused the secondary chassis to become disqualified either with the SRM modules showing no partner or the secondary module showing error EA91 You had to remove and reinsert the secondary SRM module under power to recover. Lgx00062847, Lgx00062839, Lgx00062171

Corrected Anomaly	Description
The primary SRM module rejected a synchronization command	The primary 1757-SRM module rejected a synchronization command when: • the auto-qualification option was set to Never and • the synchronization command was given within 30 seconds after disqualification of the redundant chassis pair. The SRM module continued to reject any synchronization command. You had to change the auto-qualification option to *Always* to synchronize the chassis. Lgx00062954, Lgx00058896, Lgx00037660
ENBT module wouldn't reply to a ping	Sometimes you wouldn't get a reply when you pinged a 1756-ENBT module. Lgx00062979
Updating a primary SRM module caused an unrecoverable fault	Updating the firmware of a 1757-SRM module in a primary chassis sometimes caused an recoverable fault in the controller. This happened if the controller ran out of outgoing unconnected buffers. Lgx00063005
CompactFlash image caused a major fault	A controller had a major fault if you: • stored a CompactFlash image using a controller that was last powered down as a disqualified secondary controller and • configured the image to go to run mode after loading. Lgx00063515
You couldn't download to a disqualified secondary controller without enough memory reserved for logic	You couldn't download to a disqualified secondary controller if the slider was too close to Tags.  Lgx00063587

Design the System

Use this chapter to design a redundancy system for a ControlLogix controller

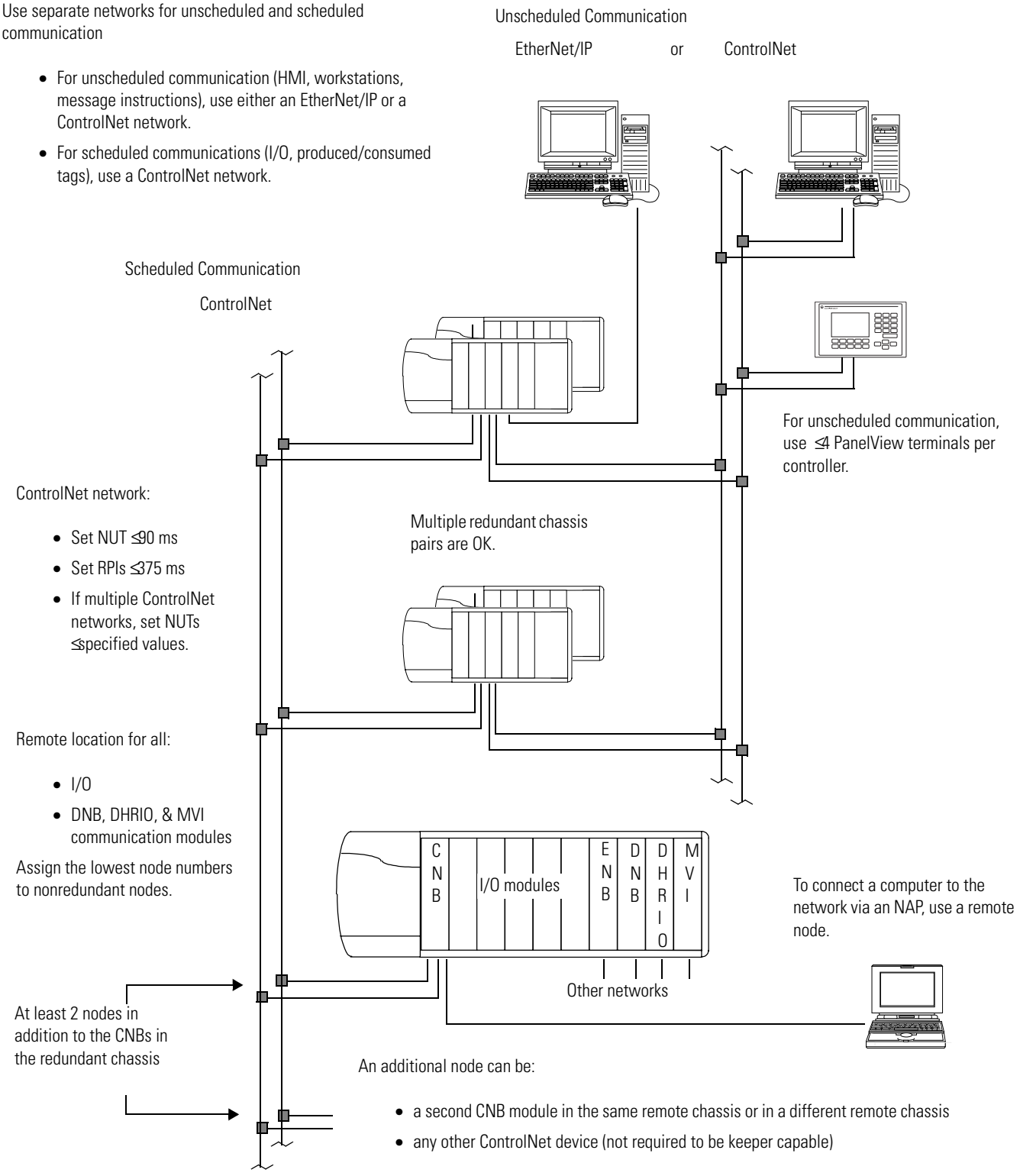
How to Use This Chapter

To design your system, complete the following tasks:

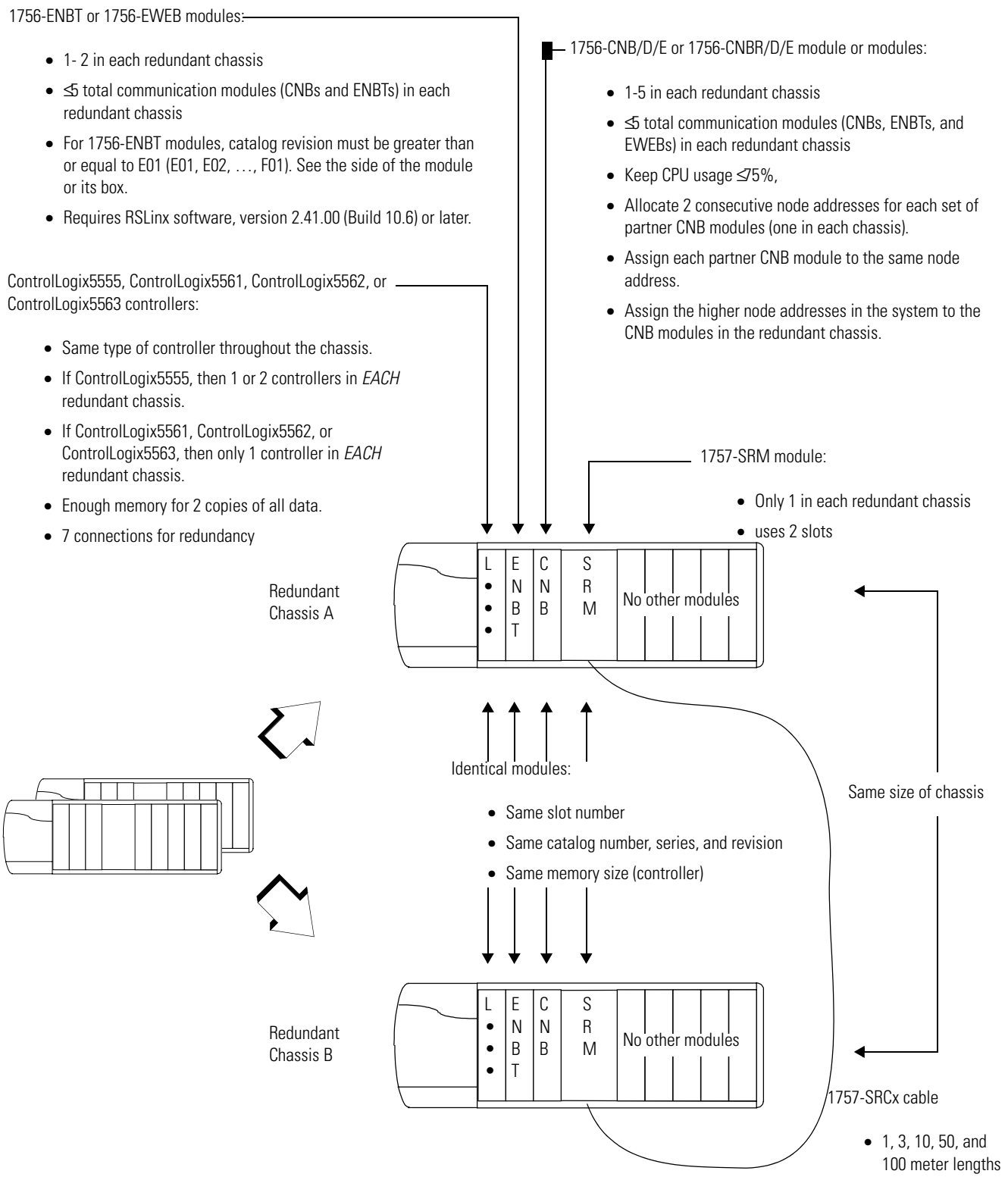
Topic	Page
Lay Out the System	30
Place the Pair of Redundant Chassis	32
Place the I/O	33
Place Operator Interface Terminals	34
Add Additional Redundant Components	35
Check Connection Requirements	37
Plan the ControlNet Networks	37
Plan the EtherNet/IP Networks	40
Additional Considerations	43

Lay Out the System

ControlLogix Redundancy Requirements and Recommendations

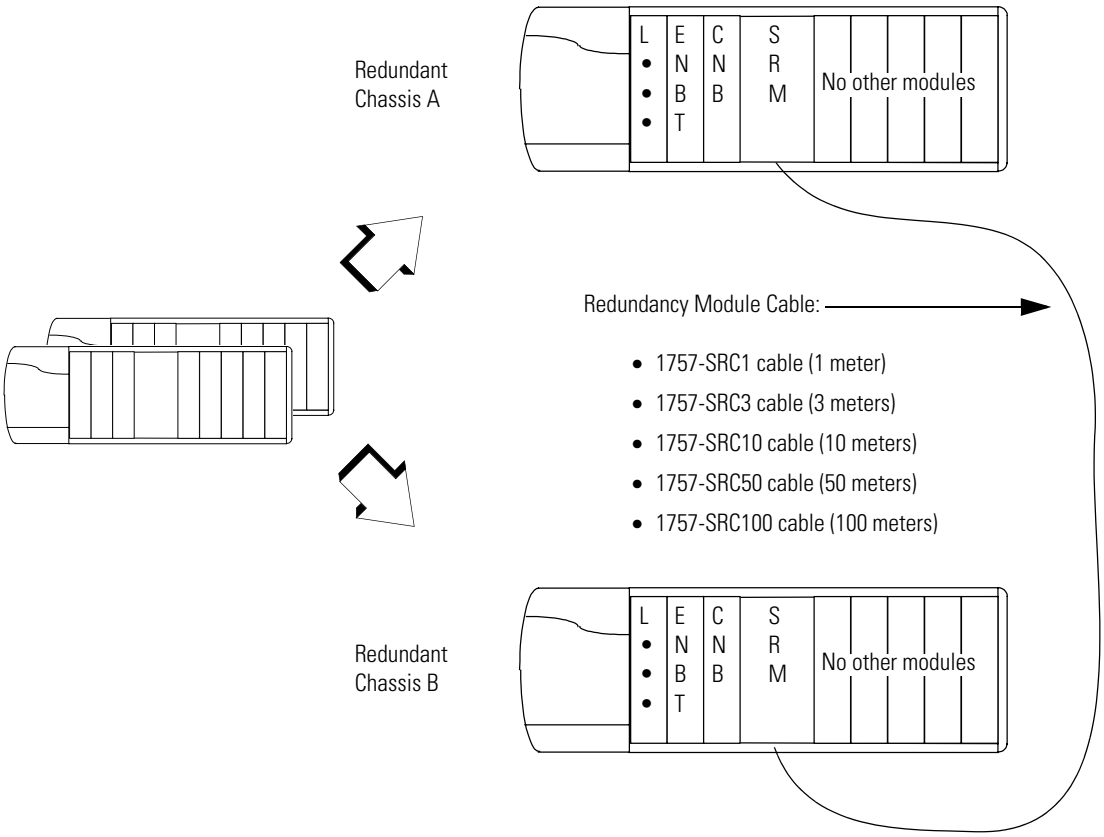

Use separate networks for unscheduled and scheduled communication
• For unscheduled communication (HMI, workstations, message instructions), use either an EtherNet/IP or a ControlNet network.
• For scheduled communications (I/O, produced/consumed tags), use a ControlNet network.
Unscheduled Communication
EtherNet/IP or ControlNet
Scheduled Communication
ControlNet
For unscheduled communication, use ≤4 PanelView terminals per controller.
ControlNet network:
• Set NUT ≤90 ms
• Set RPIs ≤375 ms
• If multiple ControlNet networks, set NUTs ≤specified values.
Multiple redundant chassis pairs are OK.
Remote location for all:
• I/O
• DNB, DHRIO, & MVI communication modules
Assign the lowest node numbers to nonredundant nodes.
CNB
I/O modules
ENB
DNB
DHRIO
MVI
To connect a computer to the network via an NAP, use a remote node.
Other networks
At least 2 nodes in addition to the CNBs in the redundant chassis
An additional node can be:
• a second CNB module in the same remote chassis or in a different remote chassis
• any other ControlNet device (not required to be keeper capable)

ControlLogix Redundancy Requirements and Recommendations (Continued)


1756-ENBT or 1756-EWEB modules:
• 1- 2 in each redundant chassis
• ≤5 total communication modules (CNBs and ENBTs) in each redundant chassis
• For 1756-ENBT modules, catalog revision must be greater than or equal to E01 (E01, E02, …, F01). See the side of the module or its box.
• Requires RSLinx software, version 2.41.00 (Build 10.6) or later.
1756-CNB/D/E or 1756-CNBR/D/E module or modules:
• 1-5 in each redundant chassis
• ≤5 total communication modules (CNBs, ENBTs, and EWEBs) in each redundant chassis
• Keep CPU usage ≤75%,
• Allocate 2 consecutive node addresses for each set of partner CNB modules (one in each chassis).
• Assign each partner CNB module to the same node address.
• Assign the higher node addresses in the system to the CNB modules in the redundant chassis.
ControlLogix5555, ControlLogix5561, ControlLogix5562, or ControlLogix5563 controllers:
• Same type of controller throughout the chassis.
• If ControlLogix5555, then 1 or 2 controllers in EACH redundant chassis.
• If ControlLogix5561, ControlLogix5562, or ControlLogix5563, then only 1 controller in EACH redundant chassis.
• Enough memory for 2 copies of all data.
• 7 connections for redundancy
1757-SRM module:
• Only 1 in each redundant chassis
• uses 2 slots
Redundant Chassis A
L
E N B T
C N B
S R M
No other modules
Identical modules:
• Same slot number
• Same catalog number, series, and revision
• Same memory size (controller)
Same size of chassis
Redundant Chassis B
1757-SRCx cable
• 1, 3, 10, 50, and 100 meter lengths

Place the Pair of Redundant Chassis

With the standard redundancy module cables, a pair of redundant chassis (primary and secondary) can function up to 100 meters apart.


Redundant Chassis A
L • • • E N B T
C N B
S R M
No other modules
Redundancy Module Cable:
• 1757-SRC1 cable (1 meter)
• 1757-SRC3 cable (3 meters)
• 1757-SRC10 cable (10 meters)
• 1757-SRC50 cable (50 meters)
• 1757-SRC100 cable (100 meters)
Redundant Chassis B
L • • • E N B T
C N B
S R M
No other modules

If You Need More Than 100 Meters Between Chassis

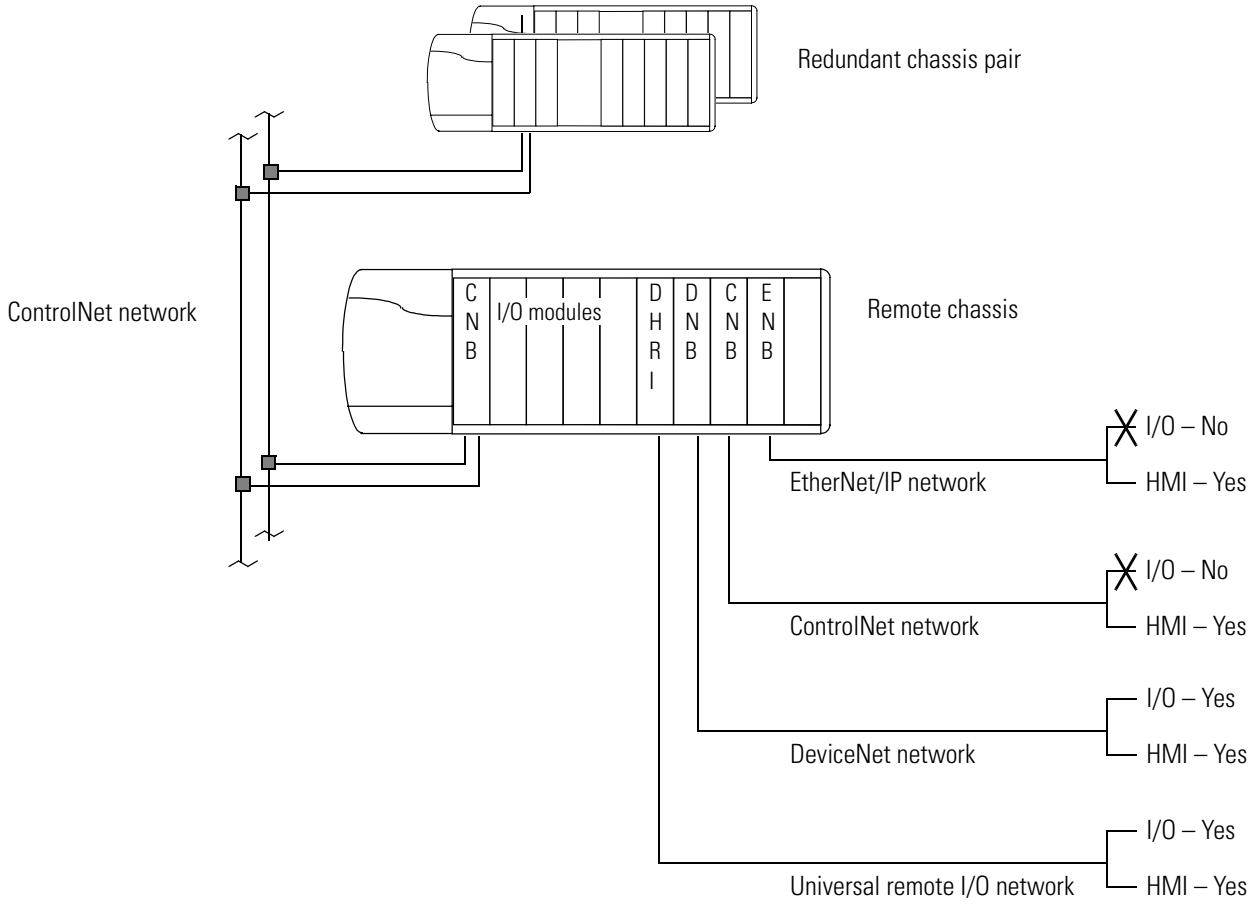
To place the primary and secondary controller chassis more than 100 meters apart, use a custom fiber optic cable. For a custom cable, follow these rules:

1. Keep total light loss through the cable less than or equal to 7dB.
2. Keep total length less than or equal to 4 km.
3. Use high quality 62.5/125 micron multi-mode fiber-optic cable.
4. Use professionally installed SC-style connectors to connect to the 1757-SRM modules.

Place the I/O

In a ControlLogix redundancy system, place all I/O in *ONLY* the following locations:

- Same ControlNet network as the redundant controllers (no bridging to I/O modules on another ControlNet network)
- DeviceNet network
- Universal remote I/O network



Place Operator Interface Terminals

For operator interface terminals, stay within these limitations:

<table>
<tr><th>For this network</th><th>And any of these operator interfaces</th><th>Follow these guidelines</th></tr>
<tr><td rowspan="4">EtherNet/IP network</td><td>PanelView Standard terminal</td><td>Same as a nonredundant system</td></tr>
<tr><td>• PanelView Plus terminal
• VersaView industrial computer running a Windows CE operating system</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Set aside connections for each PanelView Plus or VersaView CE terminal:
<table><tr><th>In this module</th><th>Set aside</th></tr><tr><td>controller</td><td>5 connections</td></tr><tr><td>CNB</td><td>5 connections</td></tr><tr><td>ENBT</td><td>5 connections</td></tr><tr><td>EWEB</td><td>5 connections</td></tr></table></td></tr>
<tr><td>RSView Supervisory Edition software with RSLinx Enterprise software</td><td>• Use RSLinx Enterprise software revision 3.0 or later.
• Use IP swapping.
• Keep the HMI and both redundant chassis on the same subnet.</td></tr>
<tr><td>• RSView Supervisory Edition software with RSLinx 2.x software
• RSView 32 software
• Any other HMI client software that uses RSLinx 2.x software</td><td>Limit the number of RSLinx servers that a controller uses to 1 (ideal) to 3 (maximum).</td></tr>
<tr><td rowspan="3">ControlNet network</td><td>• PanelView Standard terminal
• PanelView 1000e/1400e terminal</td><td>Do your terminals use unscheduled communication?
• Yes — Use ≤4 terminals per controller.
• No — Use the number of terminals that you need.</td></tr>
<tr><td>• PanelView Plus terminal
• VersaView industrial computer running a Windows CE operating system</td><td>Set aside connections for each PanelView Plus or VersaView CE terminal:
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<tr><td>• RSView Supervisory Edition software
• RSView 32 software
• Any other HMI client software that uses RSLinx 2.x software</td><td>Limit the number of RSLinx servers that a controller uses to 1 (ideal) to 3 (maximum).</td></tr>
</table>

Add Additional Redundant Components

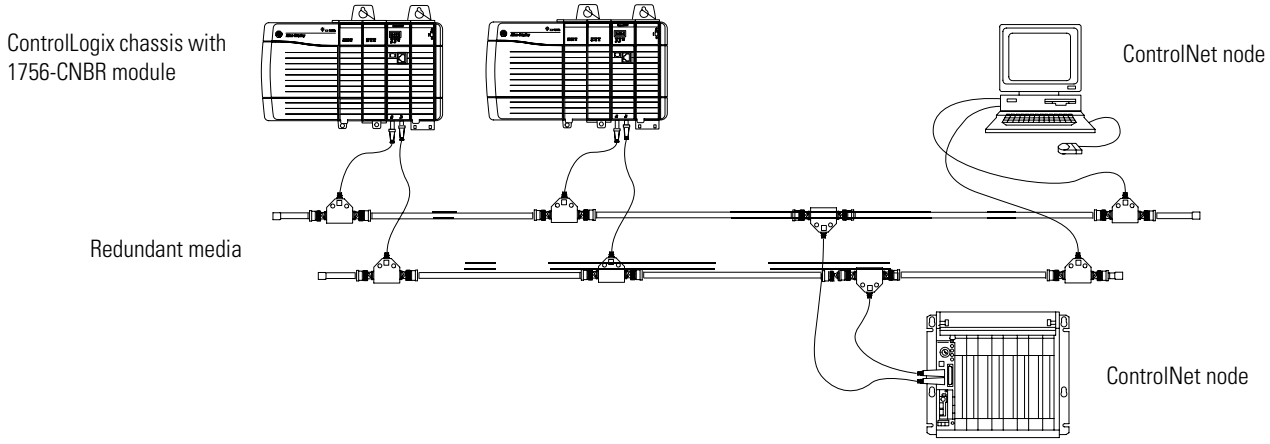
In addition to using redundant pairs of controllers, you may also add the following redundant components to your system:

- Redundant ControlNet Media
- Redundant Power Supplies

Redundant ControlNet Media

Redundant ControlNet media prevents a loss of communication if a trunkline or tap is severed or disconnected. It uses the following components:

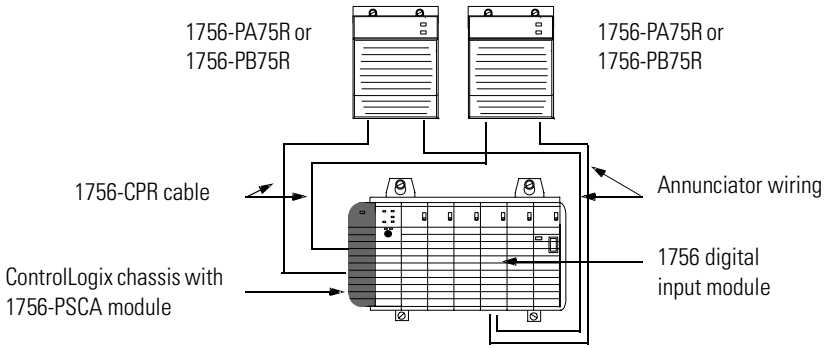
- 1756-CNBR ControlNet modules
- Two identical ControlNet links



Redundant Power Supplies

Redundant power supplies let you maintain power to a ControlLogix chassis if a power supply fails. Redundant power supplies use the following hardware:

- Two redundant power supplies, any combination of 1756-PA75R and 1756-PB75R
- 1756-PSCA chassis adapter module, in place of the standard power supply
- Two 1756-CPR cables to connect the power supplies to the 1756-PSCA adapter
- User-supplied annunciator wiring to connect the power supplies to the input modules if needed



Check Connection Requirements

Set aside seven connections in each redundant controller for redundancy communication:

- Two connections for the SRM
- Five connections for the partner controller

Plan the ControlNet Networks

Follow these guidelines to plan a ControlNet networks:

Guideline	Details
1. Make sure the network has at least 2 nodes plus the redundant chassis pair.	An additional node can be: • a second CNB module in the same remote chassis or in a different remote chassis • any other ControlNet device • a workstation that is running RSLinx software. If your ControlNet network contains only one node other than the redundant chassis pair, that node will drop its connections during a switchover. This may cause the outputs of that node to change state during the switchover.
2. Give the lowest ControlNet addresses to I/O chassis and other remote chassis.	Don't give the lowest addresses to the redundant chassis pair. If you give the lowest address to a CNB module in the redundant chassis pair: • on a switchover, you may temporarily lose communication with I/O modules, produced tags, and consumed tags. • If you remove the CNB module from the primary chassis while chassis power is on, you may temporarily lose communication with I/O modules, produced tags, and consumed tags. • If every ControlNet node powers down at the same time (for example, a plant-wide power loss), you may have to cycle the power to the primary chassis to restore communication.

Guideline	Details
3. Set aside 2 consecutive ControlNet addresses for each pair of redundant chassis (for example, nodes 3 and 4).	• If each redundant chassis has multiple CNB modules, set aside a pair of node numbers for each pair of CNB modules (one in each chassis). • Do not configure any other device on the ControlNet network for either of these addresses. For example, if you allocated nodes 3 and 4 for the redundant chassis, then no other device should use those node numbers.

Pair of CNB modules (one in each redundant chassis)	Slot and node numbers		
	Slot #	Primary node #	Secondary node # (primary node # + 1)
1st pair of CNB modules			
2nd pair of CNB modules			
3rd pair of CNB modules			
4th pair of CNB modules			
5th pair of CNB modules			

4. Know that the switchover time depends on the NUT of the ControlNet network.

Use the network update time (NUT) of the ControlNet network to estimate how long it takes your system to switchover:

If	And the NUT is	Then the switchover time is
The chassis loses power or a module fails	6 ms or less	60 ms
	7 ms or more	5 (*NUT*) + MAX (2 (*NUT*), 30)
A CNB module can't communicate with any other node	⇒	14 (*NUT*) + MAX (2 (*NUT*), 30) + 50

Example 1

The chassis loses power and the NUT = 4 ms. In that case, the switchover time is approximately 60 ms.

Example 2

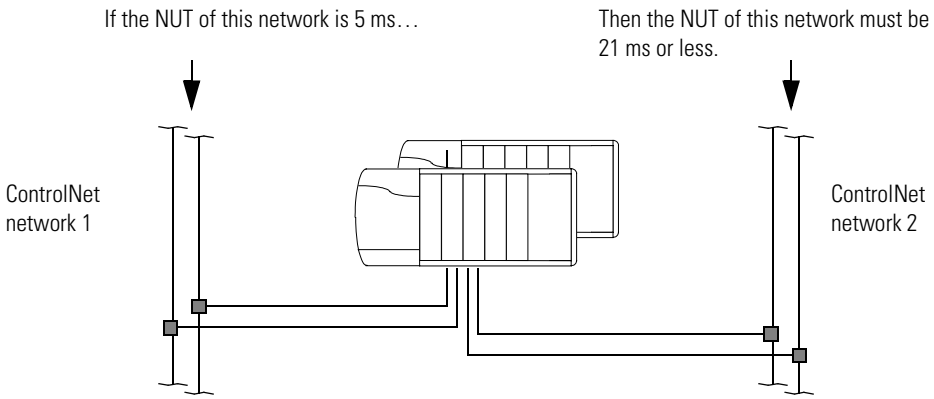
The chassis loses power and the NUT = 10 ms. In that case, the switchover time is approximately 80 ms.

Example 3

You unplug the CNB from the network and the NUT = 10 ms. In that case, the switchover time is approximately 220 ms.

5. Use a NUT that is less than or equal to 90 ms.

If you use a larger network update time (NUT), the controller could lose its connection with a module during a switchover. This could cause outputs to change state.

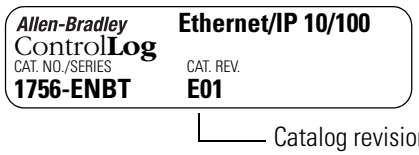
Guideline	Details
6. Do the redundant chassis use more than 1 ControlNet network? • Yes — See page 31. • No — Skip this guideline.	The NUT of each network must be within the values indicated on page 31. If you use a larger network update time (NUT), the controller could lose its connection with a module during a switchover. This could cause outputs to change state. **Example** 

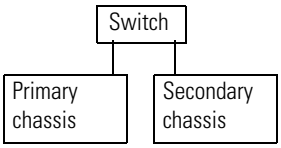
If the smallest NUT on a network is (ms):	Then the largest NUT on any other network must be less than or equal to (ms):
2	15
3	17
4	19
5	21
6	23
7	25
8	27
9	29
10	31
11	33
12	35
13	37
14	39
15	41
16	43
17	46
18	48
19	50
20	52

If the smallest NUT on a network is (ms):	Then the largest NUT on any other network must be less than or equal to (ms):
21	55
22	57
23	59
24	62
25	64
26	66
27	68
28	71
29	73
30	75
31	78
32	80
33	82
34	84
35	87
36	89
37 - 90	90

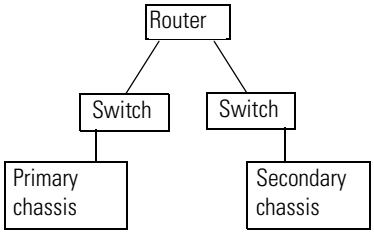
Plan the EtherNet/IP Networks

Follow these guidelines as you plan your EtherNet/IP networks:

Guideline	Details
1. Use EtherNet/IP ONLY for HMIs, workstations, and messaging.	In a redundant system, use an EtherNet/IP network only for HMI, workstation, and message communication. Do not use an EtherNet/IP network for: • control of I/O modules. • peer interlocking (produced and consumed tags). **Important**: RSLogix 5000 software lets you set up and download a project that tries to use an EtherNet/IP network for I/O, produced tags, or consumed tags. Those communications don't work however.
2. Are communication delays OK during a switchover? • If Yes, then continue with EtherNet/IP. • If No, then use ControlNet.	Communication stops over an EtherNet/IP network with your controllers and HMIs during a switchover. • You won't be able to communicate with them for up to a minute. • The actual delay depends on your network topology. If you need bumpless communication, use a ControlNet network.
3. If you need a redundant network, use ControlNet.	2 EtherNet/IP modules in same chassis doesn't give you redundant EtherNet/IP communication. A switchover still happens if one of the modules fails or a cable breaks. See How an EtherNet/IP Module Handles a Cable Break on page 42.
4. Make sure that your ENBT modules are catalog revision E01 or later. 	To use a 1756-ENBT module in a redundant controller chassis, make sure the catalog revision of the module is greater than or equal to E01 (E01, E02, …, F01). • To find the catalog revision, look at the label on the side of the module or box. • If you use an older ENBT module, your secondary chassis won't synchronize.

<table>
<tr><th>Guideline</th><th colspan="2">Details</th></tr>
<tr><td rowspan="3">5. Decide how to handle IP addresses.</td><td>If BOTH redundant chassis are on</td><td>Then</td></tr>
<tr><td>Same subnet
 
</td><td>Use IP swapping.

During a switchover the primary and secondary modules swap IP addresses. This lets you use the same IP address regardless of which chassis is primary.

See the next guideline for details.</td></tr>
<tr><td>Different subnets
 
</td><td>You MUST change to the new primary address after a switchover. Use ControlLogix Redundancy Alias Topic Switcher software to do this. See Appendix A.</td></tr>
<tr><td>6. If you're using IP swapping, give the same IP address to the primary module and its partner.</td><td colspan="2">A. Give the SAME IP address, subnet mask, and gateway address to BOTH modules in the redundant pair.

B. Leave the next highest IP address open for the secondary module.

For example

Set the primary and secondary modules to 10.10.10.10

Leave this open for the secondary 10.10.10.11

The module in the secondary chassis automatically uses the IP address of the primary + 1.</td></tr>
</table>

Worksheet for IP Swapping

Pair of ENBT or EWEB modules (one in each redundant chassis)	Slot #	Configuration			
		Primary IP address	Secondary IP address (primary address + 1)	Subnet mask	Gateway address
1st pair of ENBT or EWEB modules					
2nd pair of ENBT or EWEB modules					

How an EtherNet/IP Module Handles a Cable Break

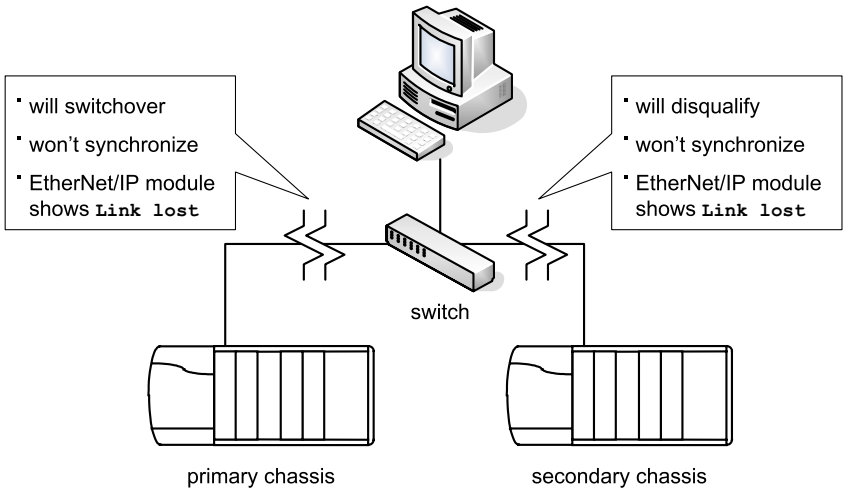
An EtherNet/IP module looks for a carrier signal only from the closest switch. It doesn't know the health of the network beyond that point. Data doesn't have to be flowing.

If the EtherNet/IP module:

- gets the carrier signal, it considers the network as OK.
- doesn't get the carrier signal, it shows `Link lost`.

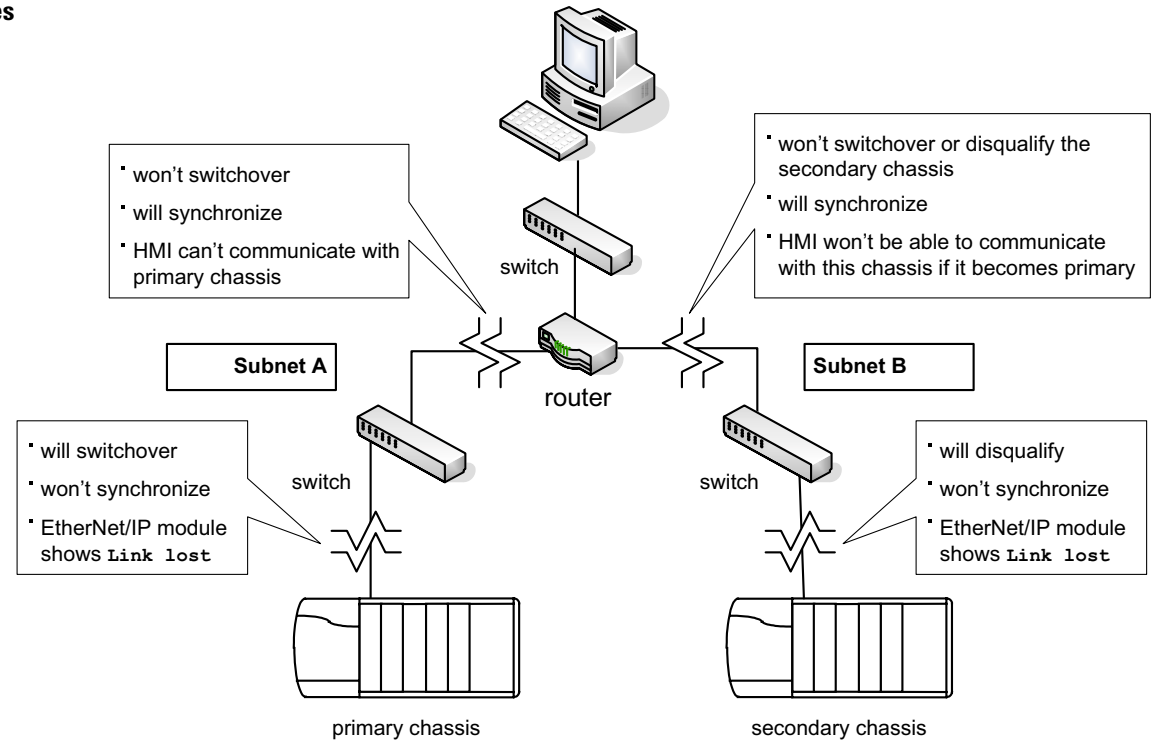
One switch

One subnet



Several switches

Several subnets



Additional Considerations

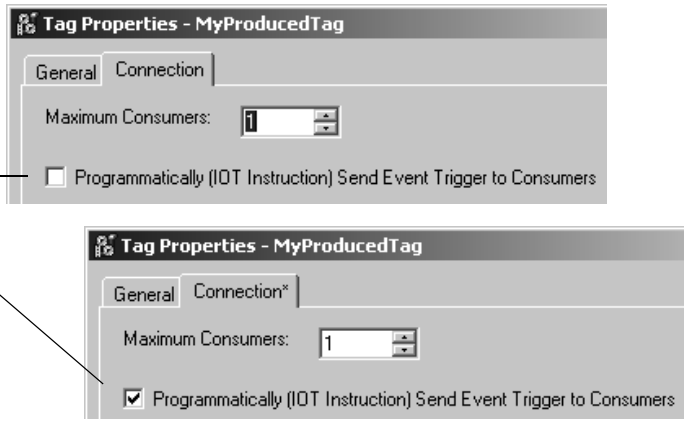
Switchover *Always* Triggers an Event Task in a Remote, Nonredundant Controller

A switchover triggers an event task under the following combination of circumstances:

- The event task is in a nonredundant controller. An Event task is not permitted in a redundant controller.
- A redundant controller triggers the event task via a produced tag.

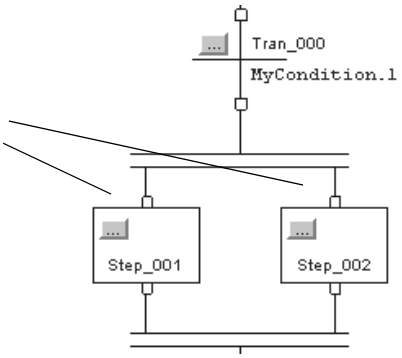
This occurs regardless of how you configure the produced tag.

Both configurations always trigger an event task during a switchover.



Simultaneous Branch Delays the Execution of a Higher Priority Task

In an SFC, each path of a simultaneous branch delays the execution of a higher priority task by up to 25 μs.



Notes:

Install the System

When to Use This Chapter

Use this chapter to install the hardware of a ControlLogix redundancy system.

How to Use This Chapter

To install the system, complete the following tasks:

Topic	Page
Review the Preliminary Information	45
Install the Chassis for the Controllers	47
Install Modules in the First Redundant Chassis	48
Install Modules in the Second Redundant Chassis	50
Install the Remote Chassis or Rails	51
Configure the EtherNet/IP Modules	52
Flash the Modules	53
Check Your Installation	53

Preliminary Information

IMPORTANT

Use of the Network Access Port (NAP)

Do not connect any device to the network access port (NAP) of a 1756-CNB/D/E or 1756-CNBR/D/E module in a redundant chassis.

- If you connect a device to the NAP of a CNB module in a redundant chassis, a switchover will fail to occur if the CNB module is disconnected from the network. While the CNB module is disconnected from the network, the controller will be unable to control any I/O devices through that CNB module.
- If you connect a workstation to the NAP of a CNB module in a redundant chassis, the workstation will be unable to go online after a switchover.

To connect a device to a ControlNet network via a NAP, use a NAP that is outside of a redundant chassis.

This chapter provides the sequence of tasks and the critical actions for the successful installation of a ControlLogix redundancy system. It does not replace the installation instructions for the components of the system. During installation, refer to the following publications:

Install this component	According to this publication
1756-A4, -A7, -A10, -A13, or -A17 chassis	*ControlLogix Chassis Installation Instructions*, publication 1756-IN080
1756-PA72 or -PB72 power supply	*ControlLogix Power Supplies Installation Instructions*, publication 1756-5.67
1756-PA75 or -PB75 power supply	*ControlLogix Power Supplies Installation Instructions*, publication 1756-5.78
ControlLogix controller	*ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101
1756-CNB/D/E or -CNBR/D/E module	*ControlLogix ControlNet Bridge Installation Instructions*, publication 1756-IN571
1756-ENBT module	*ControlLogix EtherNet/IP Bridge Module Installation Instructions*, publication 1756-IN019
1756-EWEB module	*EtherNet/IP Web Server Module Installation Instructions*, publication 1756-IN588
1757-SRM module	*ProcessLogix/ControlLogix System Redundancy Module Installation Instructions*, publication 1757-IN092

Installation instructions provide important information, such as detailed installation steps, safety considerations, enclosure requirements, and hazardous location information.

Before installing the system, review the following guidelines for safe handling of ControlLogix components:

WARNING

When you insert or remove a module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Repeated electrical arcing causes excessive wear to contacts on both a module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

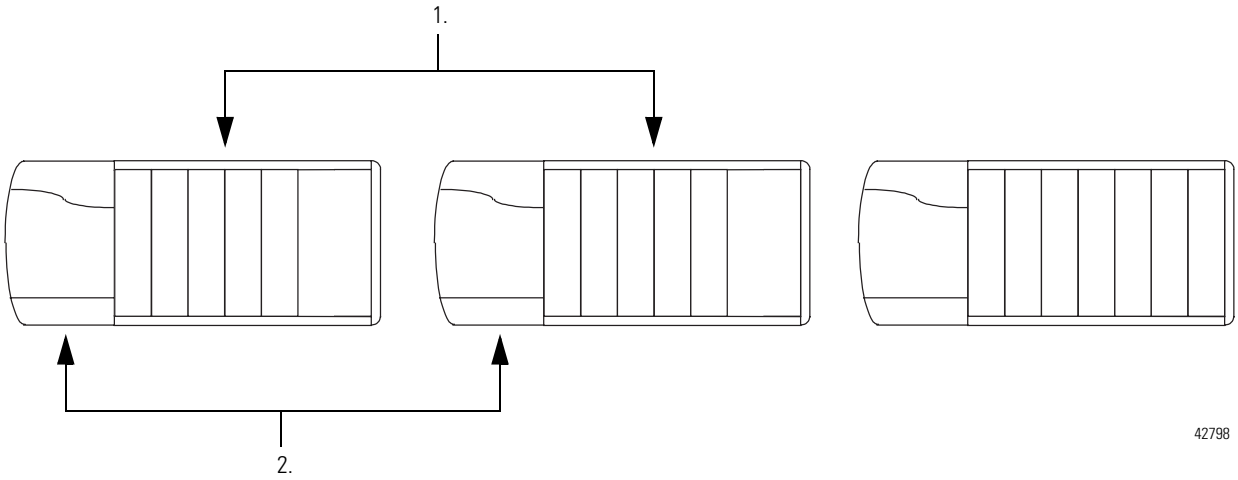
ATTENTION

Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Install the Chassis for the Controllers



1. Install the two ControlLogix chassis (redundant) that will contain the controllers.

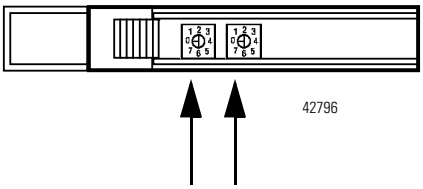
   - Place the chassis within the length of a 1757-SRCx cable.
   - Install each chassis according to the *ControlLogix Chassis Installation Instructions*, publication 1756-IN080.
   - If you are converting an existing system that contains local I/O modules, you still need two additional chassis. In a redundant system, you must place all I/O modules outside the redundant chassis pair.

2. For each chassis, install a ControlLogix power supply according to the corresponding installation instructions:

Install this power supply	According to this publication
1756-PA72	*ControlLogix Power Supplies Installation Instructions,* publication 1756-IN078B
1756-PB72	
1756-PA75R	*ControlLogix Redundant Power Supply Installation Instructions*, publication 1756-IN573C
1756-PB75R	

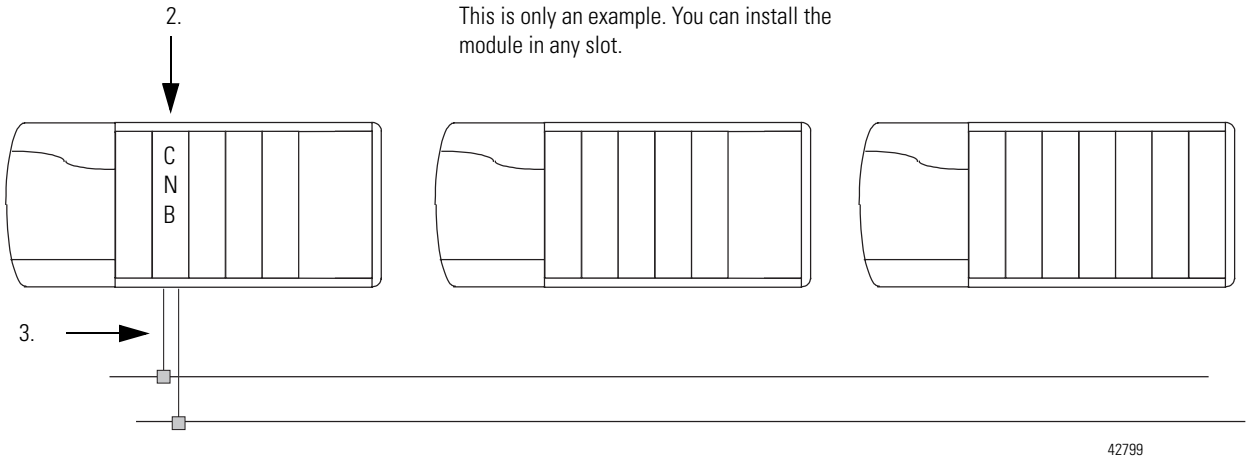
Install Modules in the First Redundant Chassis

IMPORTANT Set the rotary switches of the 1756-CNB/D/E or 1756-CNBR/D/E modules for both redundant chassis to the same node address.



1. Set the rotary switches of each of the 1756-CNB/D/E or 1756-CNBR/D/E modules to the primary node number plus one.

   For example, nodes 3 and 4 have a primary node number of 2. If you allocate nodes 3 and 4 for the redundant chassis, set both CNB modules to node 3.



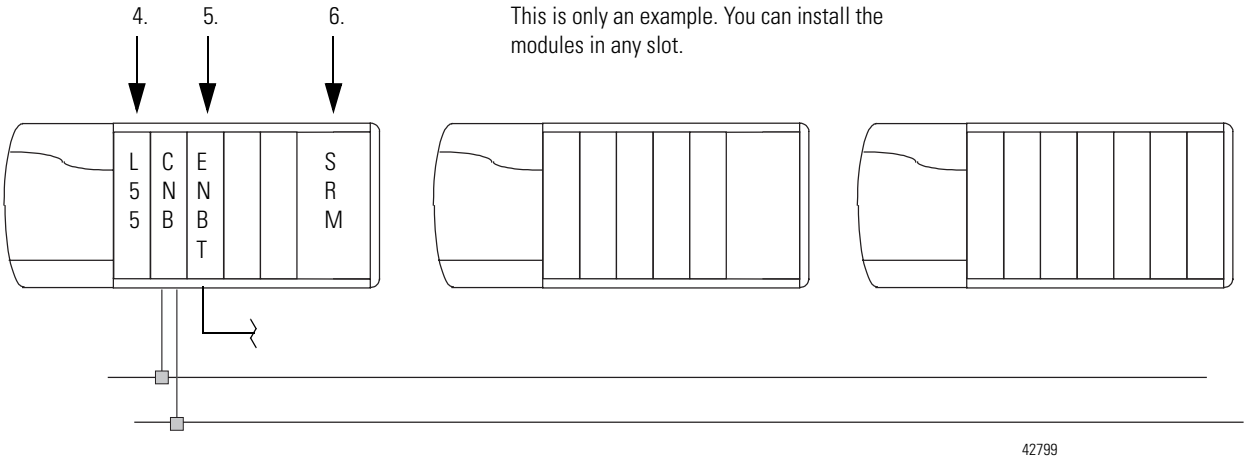
2. Install a 1756-CNB/D/E or 1756-CNBR/D/E module. See *ControlLogix ControlNet Bridge Installation Instructions*, publication 1756-IN571.

WARNING

If you connect or disconnect the communications cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

3. Connect the CNB module to the ControlNet network.

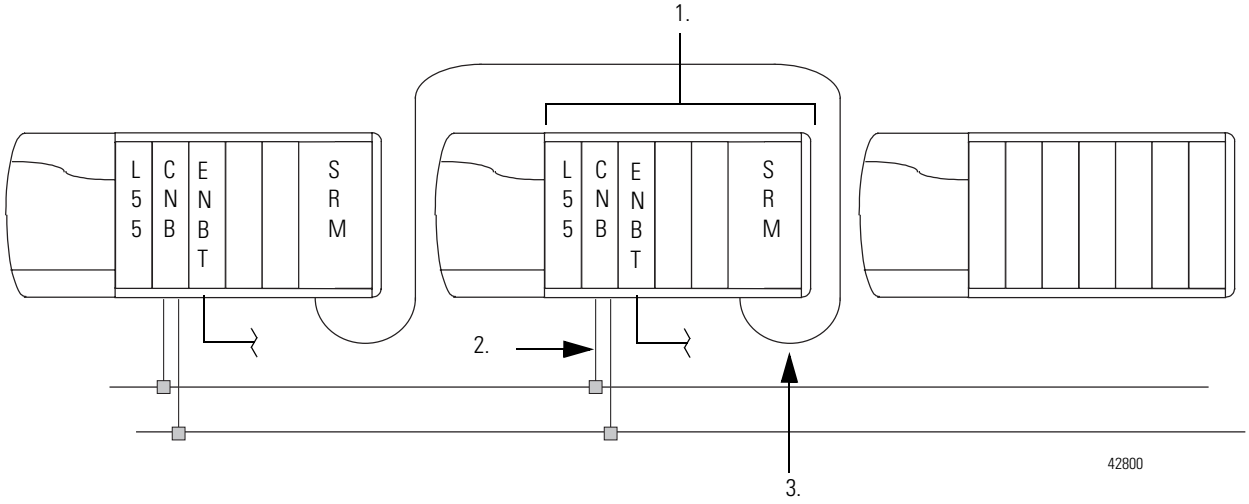


4. Install the controller or controllers. See *ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101.

5. Install the 1756-ENBT or 1756-EWEB module or modules (2 max.), if required. Connect each module to an ethernet switch.

6. Install the 1757-SRM module. See *ProcessLogix/ControlLogix System Redundancy Module Installation Instructions*, publication 1757-IN092.

Install Modules in the Second Redundant Chassis



IMPORTANT

- The modules in each redundant chassis must match each other slot-by-slot.
- Set the rotary switches of the 1756-CNB/D/E or 1756-CNBR/D/E modules for both redundant chassis to the same node address.

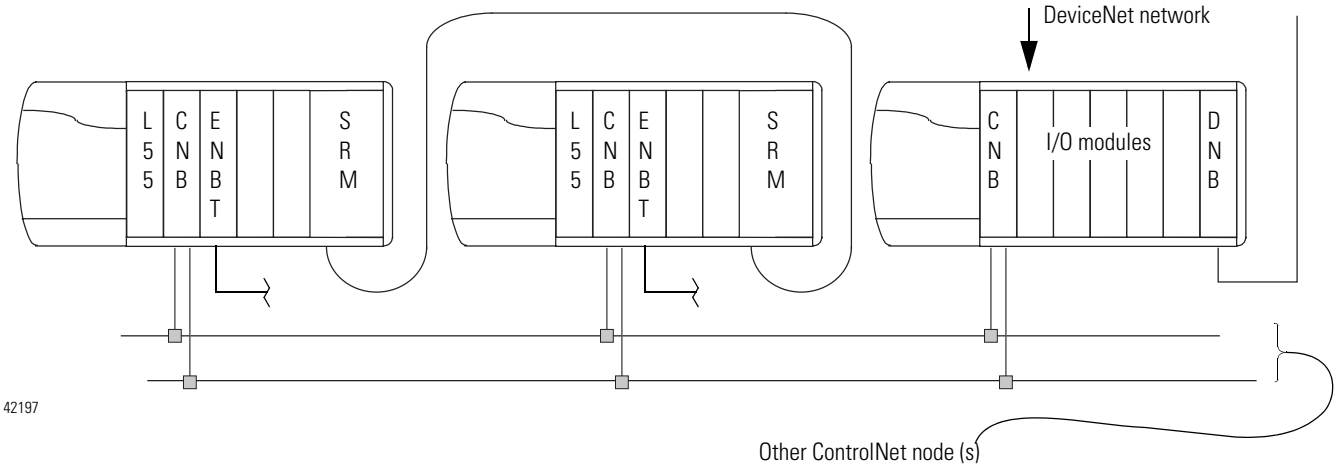
1. For each module in the first redundant chassis, install an identical module into the same slot of the second redundant chassis.

2. Connect the CNB, ENBT, and EWEB modules to their respective networks.

3. Connect one of the following fiber optic cables to the 1757-SRM modules:
   - 1757-SRC1
   - 1757-SRC3
   - 1757-SRC10
   - 1757-SRC50
   - 1757-SRC100

Install the Remote Chassis or Rails

You must install all I/O modules and additional types of communication modules in remote chassis or on DIN rails. The following example shows a remote 1756 chassis. You can use any type of chassis or device that you can connect to the ControlNet network.



You must have at least 2 other nodes in addition to the redundant chassis pair. See "Lay Out the System" on page 2.

IMPORTANT If you connect the workstation to the network via a network access port on a CNB module, use a CNB module in a remote chassis. This lets a switchover occur after the failure of a ControlNet tap of a primary chassis.

As you install the chassis, follow these guidelines:

- Do not assign any device to the address of the CNB modules in the redundant chassis plus one.

  For example, if you set the rotary switches of the CNB modules in the redundant chassis to node 11, no other device should use node 12.

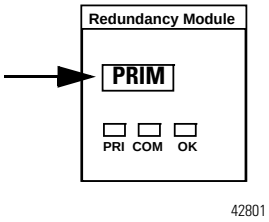
- Use a remote chassis for communication modules such as:
  - 1756-ENET
  - 1756-DHRIO
  - 1756-MVI
  - 1756-DNB

Configure the EtherNet/IP Modules

To use an EtherNet/IP module, give it an IP address, subnet mask, and gateway address:

Action	Details
1. Before you begin.	A. Perform the following steps if you haven't already: • Install and connect both 1757-SRM modules • Get the IP address, subnet mask, and gateway address for each EtherNet/IP module. See *Plan the EtherNet/IP Networks* on page 12.
	B. Do you know how to configure an EtherNet/IP module in a nonredundant system? • If no, then continue with step C. • If yes, then go to step 2.
	C. Get the following publication: *EtherNet/IP Modules in Logix5000 Control Systems*, publication ENET-UM001 You'll use that publication when you configure each module.
2. Configure the EtherNet/IP modules in the first chassis.	A. Turn on the power to only one of the redundant chassis. For example, if both chassis are on, turn off one of them.
	B. Configure the EtherNet/IP module in the chassis that is on.
	C. Do you see the IP address on the front of the module? • If no, then return to step B. • If yes, then continue with step D.
	D. Repeat steps 2B and 2C for each EtherNet/IP module in this chassis.
3. Configure the EtherNet/IP modules in the second chassis.	A. Turn off the chassis that you just configured.
	B. Turn on the other chassis.
	C. Configure the EtherNet/IP module in the chassis that is on.
	D. Do you see the IP address on the front of the module? • If no, then return to step C. • If yes, then continue with step E.
	E. Repeat steps 3C and 3D for each EtherNet/IP module in this chassis.

Flash the Modules



1. Turn on the power to one of the redundant chassis.
2. Wait for the 1757-SRM module to display PRIM.
3. Flash upgrade each module in the chassis with a compatible revision of firmware.
   - See the *ControlFLASH Firmware Upgrade Kit User Manual*, publication 1756-6.5.6.
   - To find the chassis in RSLinx software, locate the node number or IP address on the front of the communication module.
4. Turn off the power to the chassis.
5. Turn on the power to the second redundant chassis.
6. Wait for the 1757-SRM module to display PRIM.
7. Flash upgrade each module in the chassis with a compatible revision of firmware. Use the same revisions that you used for the first redundant chassis.

Check Your Installation

Purpose

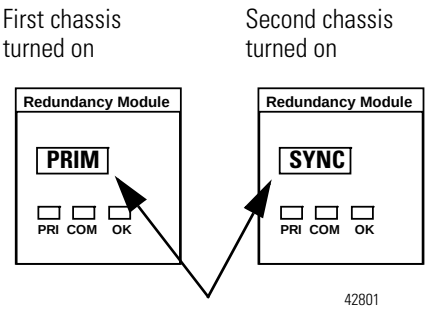
To make sure that your redundant chassis are able to synchronize

When

Complete this procedure after you:

- install the system.
- configure the communication modules.
- update firmware.

Actions



1. Turn on the chassis power to the partner (secondary) chassis.
2. Wait for the 1757-SRM module to complete its power-up cycle.
   - The SRM module takes 1 to 3 minutes to power up.
   - It may also take several minutes to synchronize the secondary controller.
3. Does 1 of the 1757-SRM modules show PRIM and the other module show SYNC?
   - Yes — Stop. The system is synchronized.
   - No — There is a problem. The system isn't synchronized. Go to step 4.
4. Make sure that the Auto-Synchronization option of the SRMs is set to *Always*. For help, see Chapter 4.
5. Does 1 of the 1757-SRM modules show PRIM and the other module show SYNC?
   - Yes— Stop. The system is synchronized.
   - No— Go to Troubleshoot a Failure to Synchronize on page 5.

Configure the System Redundancy Module

Purpose of This Chapter

This chapter shows how to set or change the configuration of a 1757-SRM module. The SRM module controls the synchronization and switchover of your redundancy system.

When to Use This Chapter

Use this chapter after you have installed your system to:

- change how the SRM supports your system.
- restart your system after redundant chassis regain power after a power loss.

How to Use This Chapter

Use this chapter as follows:

If	Do this	On page
You just installed your system	Open the SRM Configuration Tool	55
	Check the Revision of Your SRM Configuration Tool	57
	Check the Version of Your SRM Configuration Tool	59
	Set the Clock of the SRM	61
	Test a Switchover	63
You want to change how the SRM supports your system	Change the Auto-Synchronization Option	65
	Change the Program Control Option	66
Both redundancy chassis lost power	Set the Clock of the SRM	61

Open the SRM Configuration Tool

Purpose

To open the 1757-SRM System Redundancy Module configuration tool

When

Complete this procedure to:

- set the SRM clock.

- test a switchover.
- troubleshoot a system.
- store or load a project using nonvolatile memory.
- update firmware.

Before You Begin

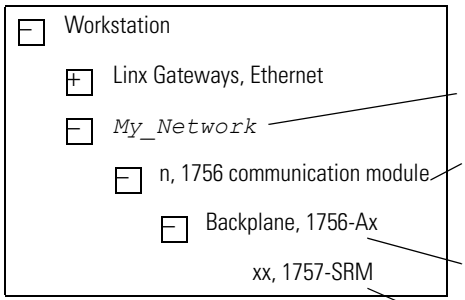
RSLinx software includes and automatically installs the 1757-SRM System Redundancy Module configuration tool.

IMPORTANT Check your revision of the SRM configuration tool when you open it for the first time.

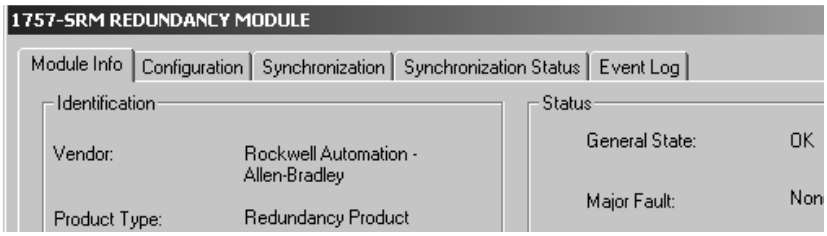
- The revision of tool that you get depends on your version of RSLinx software.
- Some revisions of the SRM configuration tool aren't compatible with some revisions of a ControlLogix Redundancy system.

The next section shows you how to see if your revision of the SRM configuration tool is right for your redundancy system.

Actions



1. Start RSLinx software.
2. From the *Communications* menu, choose *RSWho*.
3. Double-click the network to open it.
4. Double-click the communication module in the primary chassis to show the backplane.
5. Double-click the backplane to see its modules.
6. Right-click the 1757-SRM module and select *Module Configuration*.



What to Do Next

IMPORTANT Make sure that you check the revision of your SRM configuration tool before you use it. Later revisions of the SRM configuration tool aren't compatible with earlier revisions of ControlLogix redundancy systems. See *Check the Revision of Your SRM Configuration Tool* on page 57.

Check the Revision of Your SRM Configuration Tool

Purpose

To make sure that you are using the right revision of the SRM configuration tool for your ControlLogix redundancy system

IMPORTANT Make sure that you check the revision of your SRM configuration tool.

- Revision 2.6 is compatible only with revision 13.x or later ControlLogix redundancy systems.
- You'll cause the 1757-SRM module to fault if you use revision 2.6 of the tool with an revision 11.x or earlier redundancy systems.

When

Perform this procedure to:

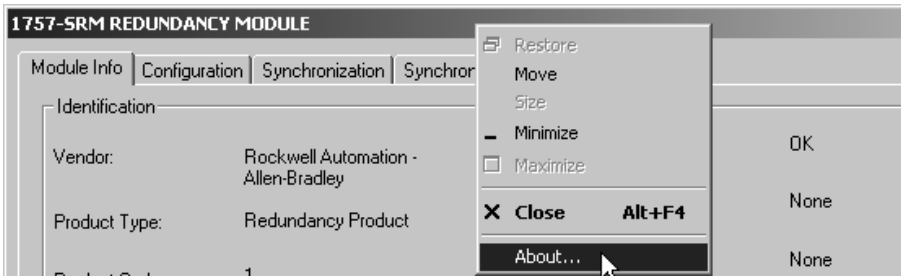
- use the SRM configuration tool for the first time.
- connect to a different ControlLogix redundancy system for the first time.
- update the firmware of a ControlLogix redundancy system.

Before You Begin

RSLinx software automatically installs the SRM configuration tool. Use the following table to see which revision of the tool that you get:

If you install	Then you get
RSLinx software revision 2.42	SRM configuration tool revision 2.5
RSLinx software revision 2.43	SRM configuration tool revision 2.6

Actions

Action	Details
1. Choose which revision to use.	Do you connect your computer to ControlLogix redundancy systems revision 11.x or earlier? • Yes — Use revision 2.5 of the SRM Configuration Tool. *DON'T* use revision 2.6. • No — Use revision 2.6 of the SRM Configuration Tool. Revision 2.6 is compatible only with revision 13.x or later ControlLogix redundancy systems. You'll cause the 1757-SRM module to fault if you use revision 2.6 of the tool with an revision 11.x or earlier redundancy systems. Keep in mind that some features are available only in revision 2.6 or later of the configuration tool.
2. See which revision you have.	A. Open the SRM configuration tool if you haven't already done so. B. Right-click the title bar of the configuration tool and choose *About…* 
3. Change your revision	If you need a different revision of the SRM configuration tool, see: Knowledgebase document G92234770. To access Rockwell Automation's Knowledgebase, go to http://support.rockwellautomation.com **Important**: The SRM configuration tool lets you install only 1 revision on your computer at the same time. To change the revision, remove the revision that you installed earlier.

Check the Version of the Configuration Tool

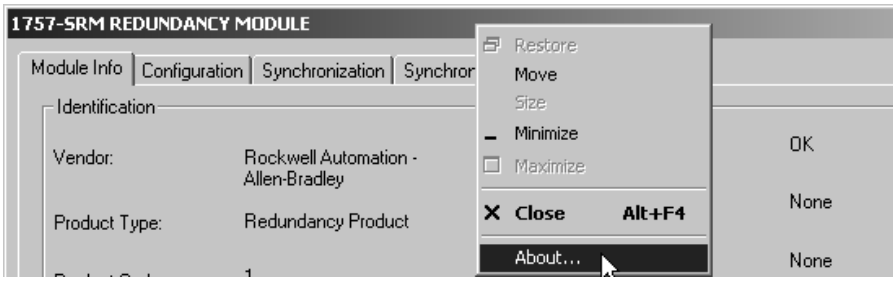
Purpose

To verify the version of your 1757-SRM System Redundancy Module Configuration tool

When

Perform this procedure before you configure your 1757-SRM module.

Actions

Action	Details
1. In RSLinx software, browse to 1757-SRM.	A. Start RSLinx software. B. Browse to your 1757-SRM.
2. Identify the configuration tool version	A. Right-click the SRM and choose *Module Configuration*.  B. Right-click the title bar of the configuration tool and choose *About…*

Set the Clock of the SRM

Purpose

To set clock of the 1757-SRM module

When

Perform this procedure:

- after system installation.
- after power loss to both chassis.

Before You Begin

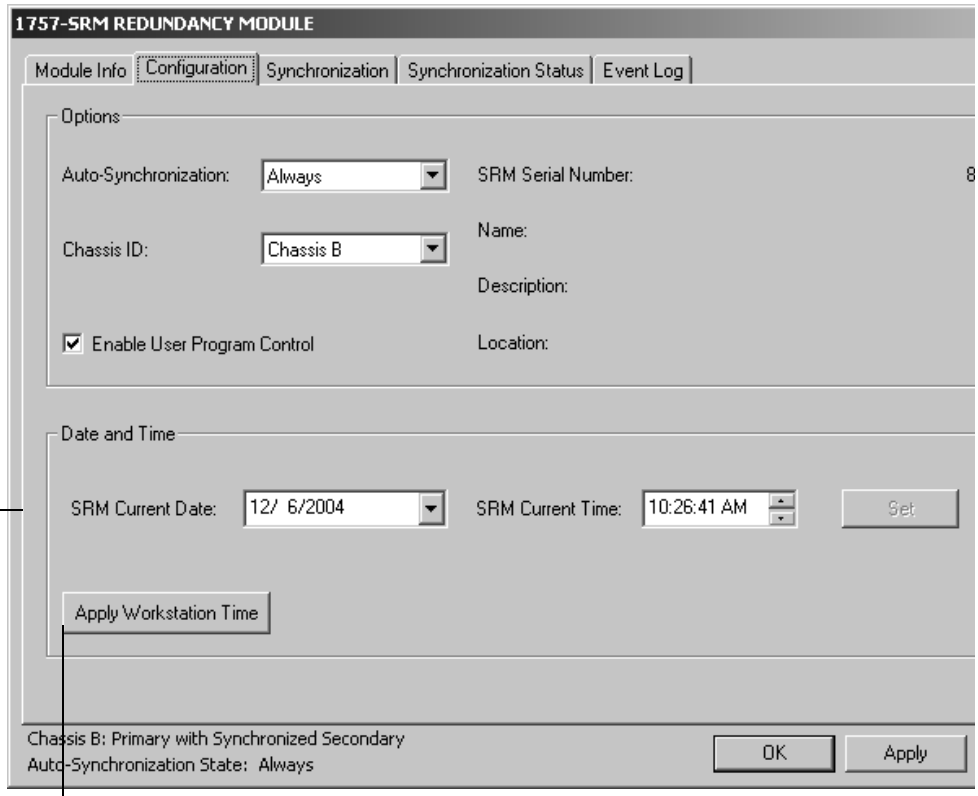
The SRM clock records when significant events occur. Please note the following characteristics of the SRM clock:

- Only the primary SRM's clock requires setting. The secondary SRM's clock synchronizes itself to the primary SRM's clock.
- The SRM has no battery to keep its clock running. The clock stops without SRM power.
- With power, the primary SRM synchronizes its clock to the most recent event in its event log.
- The secondary SRM event log records when the secondary SRM powered up. Look for *WCT time change (> 1 second)* event.
- An SRM with a firmware revision 3.37 or earlier doesn't log its power-down time. If only one of the chassis powers down, use the event log of the other chassis to see when it happened. Look for *The partner RM screamed* event. See Interpret the SRM Event Log on page 10.

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the network branches until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.

Action	Details
2. Set the clock.	A. Click *Configuration*.



B. Do you want to set the clock of the SRM to the clock of your computer?

If	Then
Yes	Choose *Apply Workstation Time* and then *Yes*.
No	1. Change the date or time. 2. Choose *Set* and then *Yes*.

C. Choose *OK*.

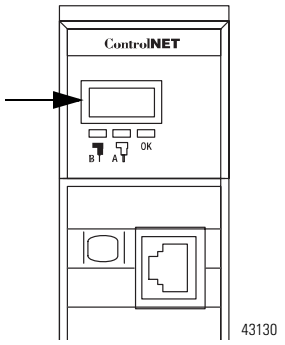
Test a Switchover

Purpose

To use RSLinx software to manually initiate a switchover

When

Perform this procedure after you've synchronized your system and want to test a switchover.



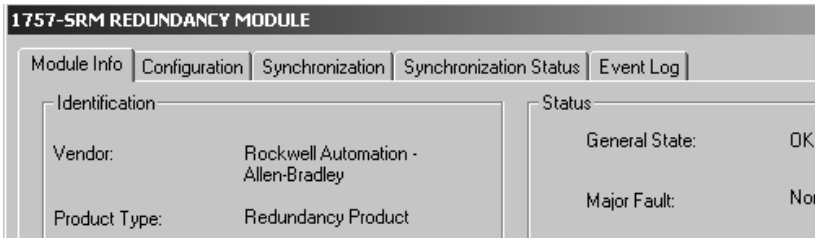
Before You Begin

The CNB modules in the new primary chassis show the synchronization progress after a switchover. Typically, the modules show the following sequence:

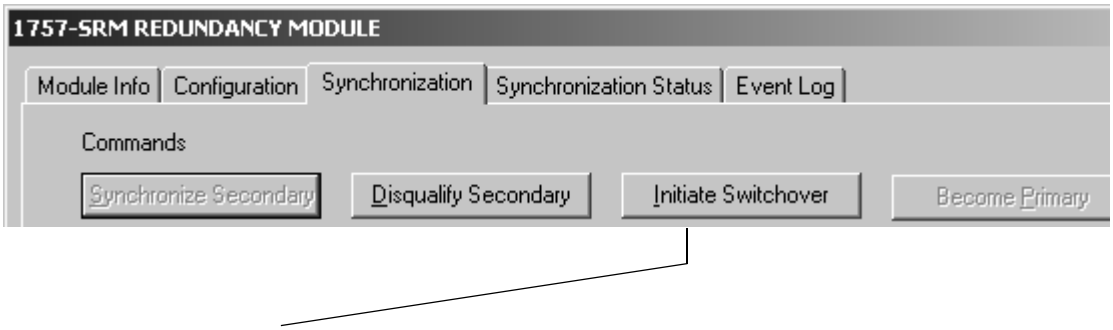
PwNS ⇒	*PwDS* ⇒	*PwQg* ⇒	*PwQS*
primary with no secondary	primary with disqualified secondary	primary with synchronizing (qualifying) secondary	primary with synchronized (qualified) secondary

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the network branches until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.



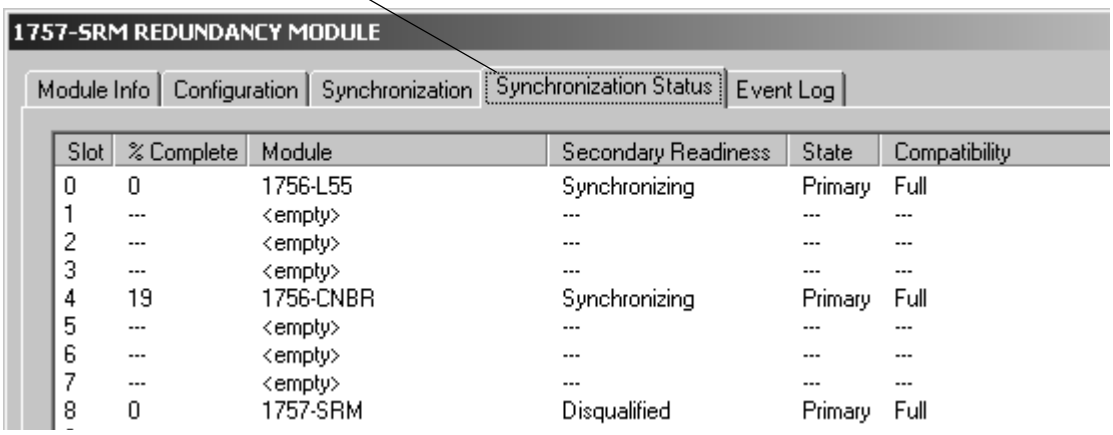
Action	Details
2. Start a switchover.	A. Click *Synchronization*.



B. Choose *Initiate Switchover* and then choose *Yes* to continue.

3. Monitor the synchronization progress.

A. Click *Synchronization Status*.

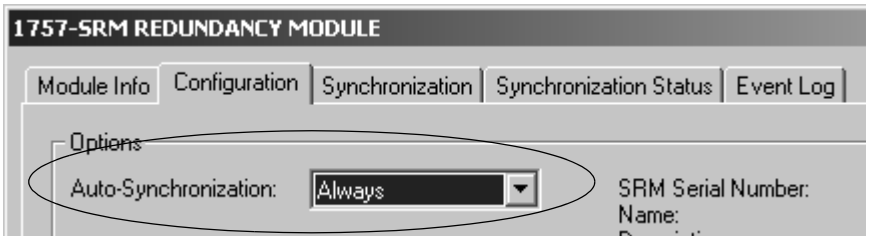


Slot	% Complete	Module	Secondary Readiness	State	Compatibility
0	0	1756-L55	Synchronizing	Primary	Full
1	---	<empty>	---	---	---
2	---	<empty>	---	---	---
3	---	<empty>	---	---	---
4	19	1756-CNBR	Synchronizing	Primary	Full
5	---	<empty>	---	---	---
6	---	<empty>	---	---	---
7	---	<empty>	---	---	---
8	0	1757-SRM	Disqualified	Primary	Full

If the controller contains a large project, the system may spend some time synchronizing the secondary controller.

B. If the *Secondary Readiness* remains *Disqualified*:

- Make sure the Auto-Synchronization option = Always.



- See "Troubleshoot a Failure to Synchronize" on page 5.

Change the Auto-Synchronization Option

Purpose

To change when the 1757-SRM module tries to synchronize the controllers

When

Perform this procedure to:

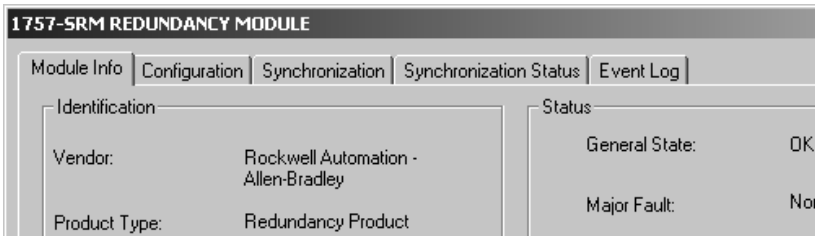
- help synchronize the system.
- prevent the system from crossloading changes.

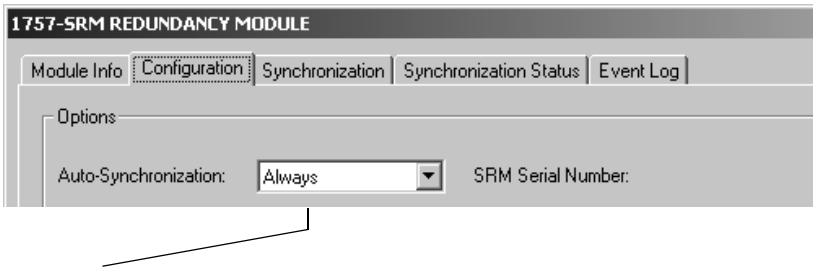
Actions

Action	Details
1. Decide when you want the system to synchronize.	Do you plan to manually disqualify a chassis so you can make changes? • No — Choose Always • Yes — Choose Conditional

If you choose:	Then:
Conditional	The SRM keeps the synchronization command that you give it. If you: • synchronize the secondary, the SRM always tries to keep the controllers synchronized. • disqualify the secondary, the SRM keeps the controller unsynchronized (disqualified). It doesn't crossload changes.
Never	The controllers won't try to synchronize, but you can still manually synchronize the controllers.

2. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.



Action	Details
3. Set the auto-synchronization option.	A. Click *Configuration*.  B. Select the *Auto-Synchronization* option. C. Choose *Apply* and then *Yes* to continue. D. Choose *OK*.

Change the Program Control Option

Purpose

To let the controller send a message to the 1757-SRM module or block the controller from sending a message to the 1757-SRM module

When

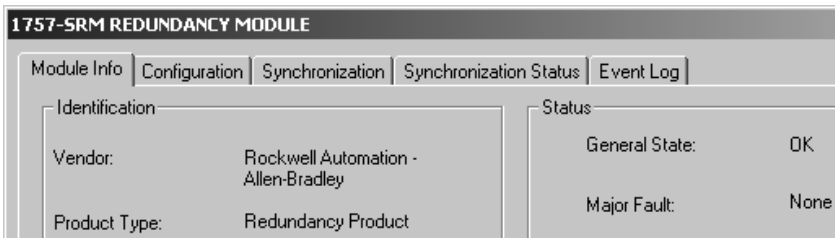
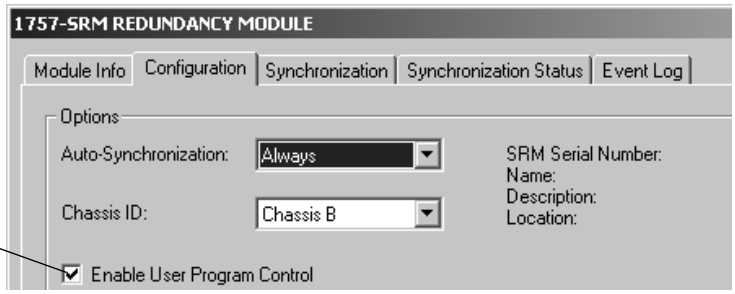
Do this procedure when you:

- initially configure the SRM.
- decide to send the SRM a message from the controller.

Before You Begin

See page 94 for a list of messages that a controller can send to an SRM module.

Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open all the network branches to find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 
2. Set the program control option.	A. Click *Configuration*. B. Do you want to let a controller send a message to the SRM? • Yes — Check the *Enable User Program Control* check box. • No — Uncheck the *Enable User Program Control* check box.  C. Choose *Apply* and then *Yes* to continue. D. Choose *OK*.

Notes:

Configure and Program the Controller

When to Use This Chapter

After having installed a system, use this chapter to configure and program the controller for redundancy.

IMPORTANT Create and maintain only one RSLogix 5000 project for the pair of redundant controllers. When you download the project to the primary controller, the project automatically crossloads to the secondary controller.

How to Use This Chapter

To configure and program a controller, complete the following tasks:

Topic	Page
Plan for Online Edits	69
Configure Communications	74
Estimate the Crossload Time of a Program	77
Minimize Scan Time	79
Maintain the Integrity of Your Data During a Switchover	85
Determine the Status of Your Redundancy System	90
Condition Logic to Run After a Switchover	91
Send a Message to the SRM	94
Download the Project to the Primary Controller	98
Schedule the ControlNet Networks	98
Set the Task Watchdog Times	102

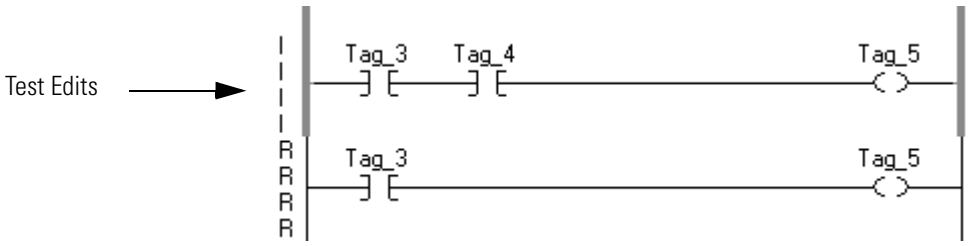
Plan for Online Edits

Before editing online:

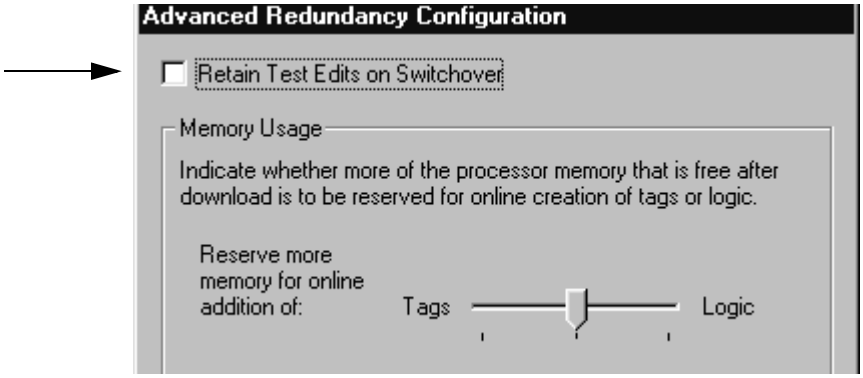
- decide if you want to keep test edits after a switchover.
- be aware that finalizing edits removes your original logic.
- decide how you want to set aside unused memory.

Decide if You Want to Keep Test Edits after a Switchover

When you edit logic while online with the controller, the edits may fault the controller and cause a switchover.



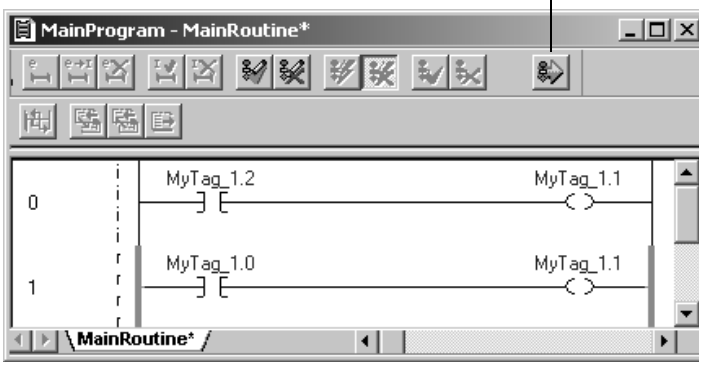
If test edits fault the primary controller, they will likely also fault the secondary controller. To prevent faulting, any test edits are deactivated (untested) during a switchover. As an option, you can keep the edits active after a switchover:


Advanced Redundancy Configuration
Retain Test Edits on Switchover
Memory Usage
Indicate whether more of the processor memory that is free after download is to be reserved for online creation of tags or logic.
Reserve more memory for online addition of:
Tags
Logic

If you want to	Then
Prevent an incorrect online edit from faulting both the primary and secondary controller	Do not retain test edits (default setting).
Keep test edits active during a switchover (at the risk of faulting both controllers)	Retain test edits.

Be Aware That Finalizing Edits Removes Your Original Logic

Finalize All Edits in Program

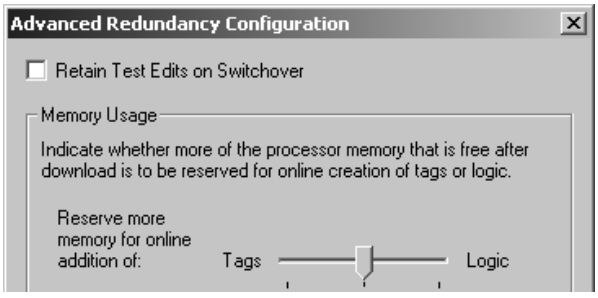


The controller removes the original logic when you finalize all edits in a program. If your changes cause a major fault and a switchover, the new primary controller also faults. That's because there's *NO* original logic to go back to. For example, the new primary controller can't untest the edits.

This happens even if you set the controller to untest edits on a switchover.

Decide How You Want to Set Aside Unused Memory

IMPORTANT We recommend that you leave the Memory Usage slider in the middle (default).


Advanced Redundancy Configuration
Retain Test Edits on Switchover
Memory Usage
Indicate whether more of the processor memory that is free after download is to be reserved for online creation of tags or logic.
Reserve more memory for online addition of:
Tags
Logic

When the secondary controller receives crossload data, it first buffers tag data in a quarantine section of memory. When it has all of the data and knows it is valid, it moves the data into the main memory area. That is why a redundant controller requires twice as much memory for tags as a nonredundant controller.

The controller sets up the quarantine area at the time of download:

- The controller divides its memory into two sections:
  - tags, including a quarantine area
  - logic
- The controller also divides its unused memory. It reserves a specific amount for tags that you create while online. The rest for logic.

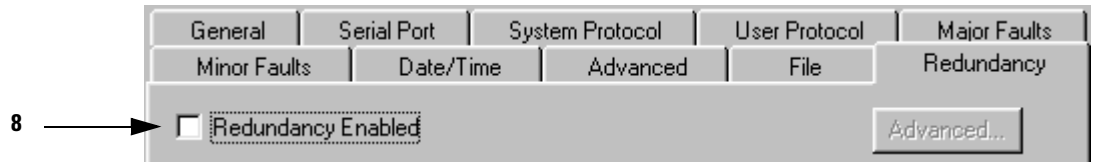
You configure how to reserve unused memory between tags and logic. You do this online in program mode.

If you plan to	Then	Notes
While online, create roughly the same amount of new tags and new logic	Leave the default setting.	
While online, create a relatively large amount of new tags but a much smaller amount of new logic	Drag to slider toward *Tags*.	Avoid setting the slider all the way to *Tags*: • You will be unable to perform online edits. • OPC communications may error or fail.
While online, create a relatively large amount of new logic but a much smaller amount of new tags	Drag to slider toward *Logic*.	Avoid setting the slider all the way to *Logic*; you will be unable to create tags while online.

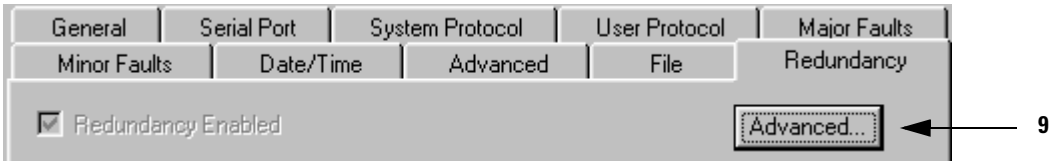
Configure a Controller for Redundancy

1. Open or create the RSLogix 5000 project.

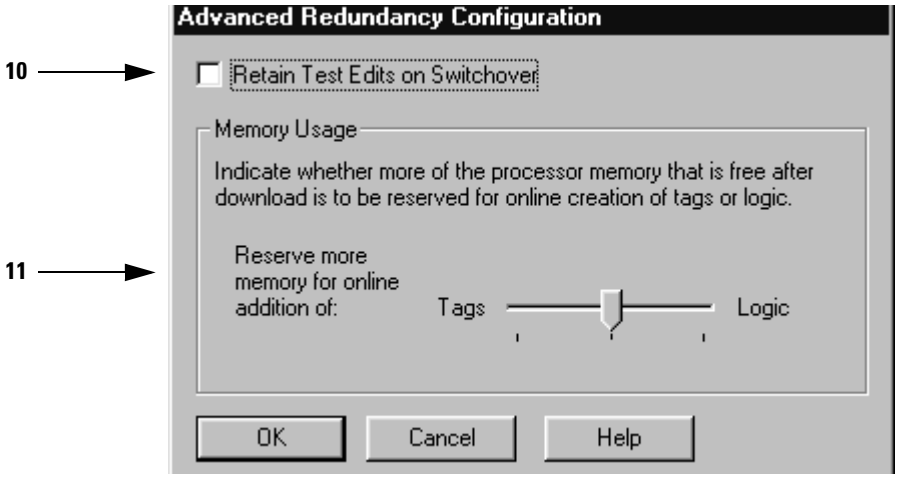
2. On the Online toolbar, click the controller button.
3. Does *General* display the controller type?
   - If no, go to step 4.
   - If yes, go to step 7.
4. Click the *Change Type* button.
5. Select your controller.
6. Choose *OK*.
7. Click *Redundancy*.



8. Select the *Redundancy Enabled* check box.



9. Click the *Advanced* button.



10. We recommend that you not check this box. Leaving it unchecked prevents an incorrect online edit from faulting both the primary and secondary controller.

If you want any test edits to remain active during a switchover, then check this box. However, by doing so, you run the risk of faulting both controllers.

11. We recommend that you leave the Memory Usage slider in the middle, the default position.

12. Choose OK

13. To close the Controller Properties dialog box,

choose OK

Configure Communications

A redundant system requires some specific configuration choices for successful communications. Use this section to perform the following redundancy tasks:

- Configure I/O
- Configure produced tags
- Configure message (MSG) instructions
- Configure tags for an HMIConfigure I/O

IMPORTANT For each module in your system, make sure that the requested packet interval (RPI) is less than or equal to 375 milliseconds. If you use a larger RPI, the controller could lose its connection with the module during a switchover. This could cause outputs to change state.

For any outputs that require a bumpless switchover:

- put those outputs in the highest priority task.
- configure only that task at the highest priority.

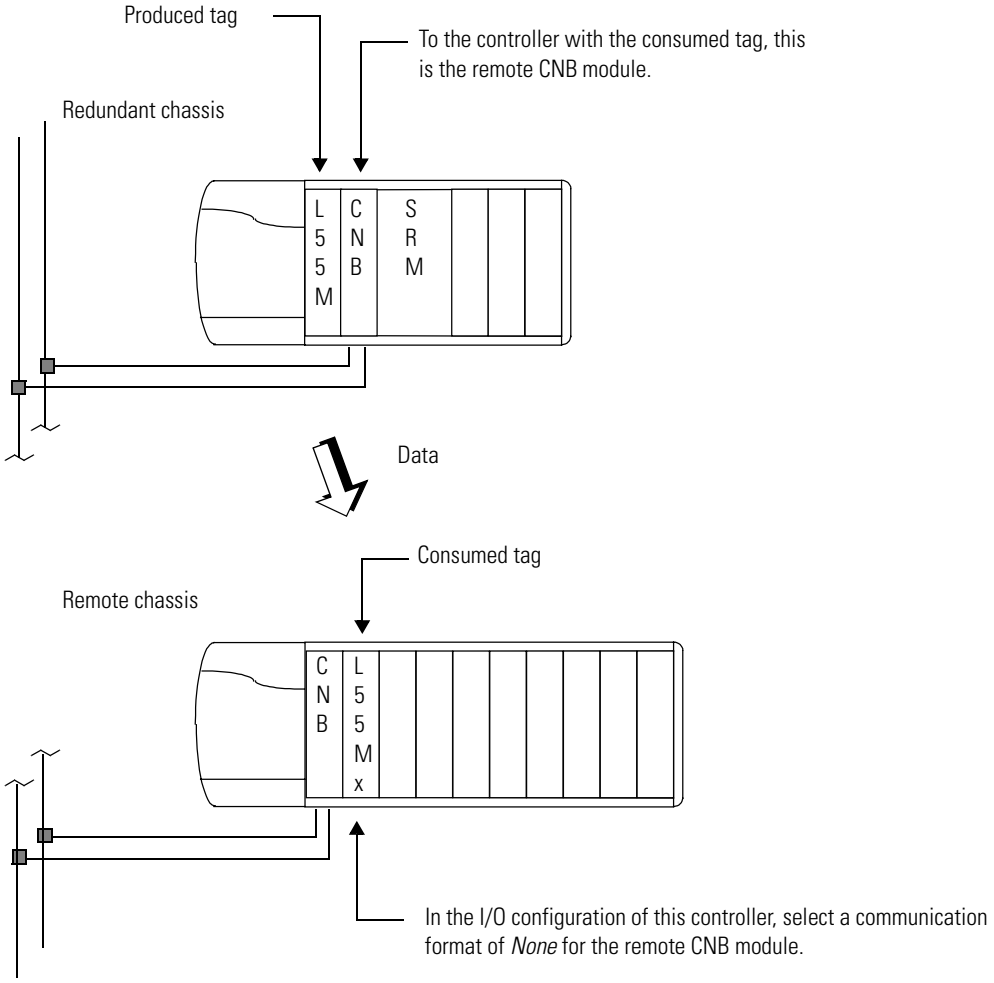
Configure Produced Tags

IMPORTANT During a switchover, the connection for tags that are consumed *FROM* a redundant controller may time out.

- The data *DOES NOT* update.
- The logic acts on the last data that it received.

After the switchover, the connection reestablishes and the data begins to update again.

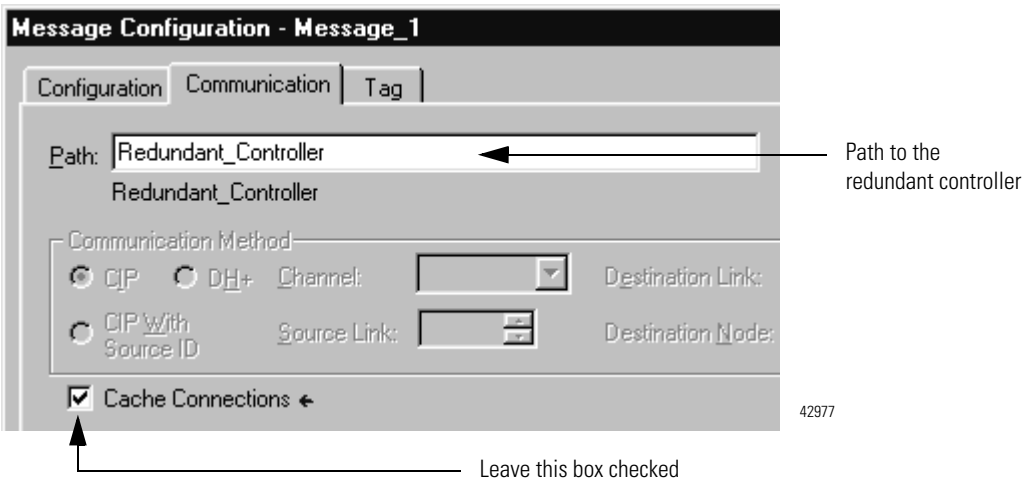
If you want a controller in another chassis to consume a tag from the redundant controller, use a comm format of *None*. In the I/O configuration of the consuming controller, select a comm format of *None* for the remote CNB module (the CNB that is physically in the redundant chassis).


Produced tag
To the controller with the consumed tag, this is the remote CNB module.
Redundant chassis
L 5 5 M
C N B
S R M
Data
Consumed tag
Remote chassis
C N B
L 5 5 M x
In the I/O configuration of this controller, select a communication format of *None* for the remote CNB module.

Configure Message (MSG) Instructions

If the MSG instruction is	Then
From a redundant controller	In a redundant controller, any MSG instruction that is in progress during a switchover experiences an error. (The ER bit of the instruction turns on.) After the switchover, normal communication resumes.
To a redundant controller	For any MSG instruction from a controller in another chassis to a redundant controller, cache the connection:

Properties of the Message to the Redundant Controller



Configure Tags for an HMI

To monitor tags directly in the secondary controller (not typical), monitor from no more than 3 devices through a CNB module.

Monitor tags in a secondary controller only via:

- RSLogix 5000 software
- Any method that does not try to create OPC optimized packets. Only a primary controller can create an OPC optimized packet.

Estimate the Crossload Time of a Program

Purpose

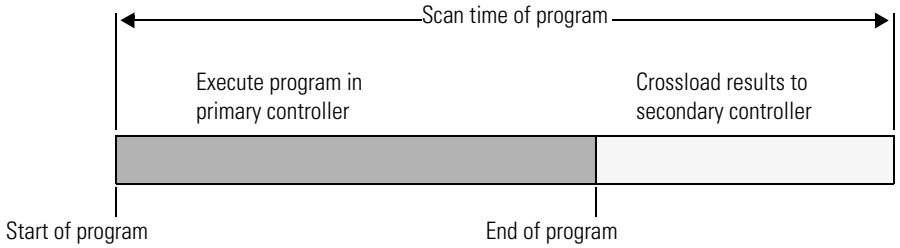
To estimate the crossload time of a program in a redundant controller

When

Perform this procedure to gauge the time a project spends crossloading data.

Before you begin

Consideration	Details
The controller crossloads data at the end of every program.	The primary controller stops at the end of every program to crossload fresh data to the secondary controller. This keeps the secondary controller up to date and ready to take over. It also increases the scan time when compared to a nonredundant system.
The crossload time depends on how much data changed.	The length of time for the crossload depends on the how much data the primary controller has to crossload. • The primary controller crossloads any tag to which an instruction wrote a value (even the same value) since the last crossload. • Crossloading also requires a small amount of overhead time to tell the secondary controller which program the primary controller is executing.
In a redundant system, a ControlLogix5561, 5562, or 5563 controller is up to 30% faster than a ControlLogix5555 controller.	The scan time improvement of ControlLogix5561, 5562, and 5563 controllers is less in a redundant system is than in a nonredundant system. • Even though the ControlLogix5561, 5562, and 5563 controllers execute logic faster, they must still crossload data. • Given the same project and redundant system, a ControlLogix5561, 5562, or 5563 controller is up to 30% faster than a ControlLogix5555 controller.


Scan time of program
Execute program in primary controller
Crossload results to secondary controller
Start of program
End of program

Actions

<table>
<tr><th>Action</th><th>Details</th></tr>
<tr><td>1. Get the size of your crossload data.</td><td>Use a Get System Value (GSV) instruction to read the REDUNDANCY object.

<table>
<tr><th>For this information</th><th>Get this attribute</th><th>Data Type</th><th>Description</th></tr>
<tr><td>• Size of the last crossload
• Size of the last crossload if you had a secondary chassis</td><td>LastDataTransfer Size</td><td>DINT</td><td>This attribute gives the size of data that was or would have been crossloaded in the last scan.

• The size in DINTs (4-byte words).
• You must configure the controller for redundancy.
• You don't need a secondary chassis.

Is there a synchronized secondary chassis?

• Yes — This gives number of DINTs that was crossloaded in the last scan.
• No — This gives number of DINTs that would have been crossloaded in the last scan.</td></tr>
<tr><td>• Size of the biggest crossload
• Size of the biggest crossload if you had a secondary chassis</td><td>MaxDataTransfer Size</td><td>DINT</td><td>This attribute gives the biggest size of the LastDataTransfer Size attribute.

• The size in DINTs (4-byte words).
• You must configure the controller for redundancy.
• You don't need a secondary chassis.
• To reset this value, use an SSV instruction with a Source value of 0.

Is there a synchronized secondary chassis?

• Yes — This gives biggest number of DINTs that was crossloaded.
• No — This gives biggest number of DINTs that would have been crossloaded.</td></tr>
</table>

See Logix5000 Controllers General Instructions Reference Manual, publication 1756-RM003, for more information on the GSV and SSV instructions.</td></tr>
<tr><td>2. Estimate the crossload time.</td><td>Which controller do you have?

• If ControlLogix5555, then crossload time = (0.0015 ms * DINTs) + 1 ms overhead
• If ControlLogix5561, then crossload time = (0.0013 ms * DINTs) + 1 ms overhead
• If ControlLogix5562, then crossload time = (0.0013 ms * DINTs) + 1 ms overhead
• If ControlLogix5563, then crossload time = (0.0013 ms * DINTs) + 1 ms overhead

where DINTs is the size of tag data to be crossloaded, measured in 4-byte words.</td></tr>
</table>

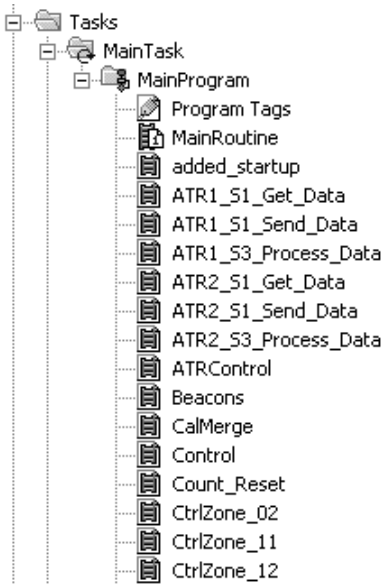
Minimize Scan Time

To minimize a project's scan time, perform the following procedure:

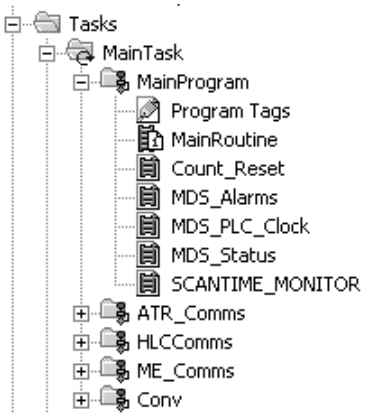
IMPORTANT Don't try to get the scan time of a ControlLogix redundancy project down below about 20 milliseconds. At very low scan times, crossload data becomes a bigger performance burden. This burden limits the minimum scan time.

Action	Details
1. Use a few large programs instead of a lot of small programs.	The controller stops at the end of every program to crossload data. So the more programs that you have, the more the controller stops to crossload. And it often ends up crossloading the same data many times. To cut down the number of crossloads: A. Use only one or a few programs. B. Divide each program into whatever number of routines makes the most sense. A routine doesn't cause a crossload. C. Use the main routine of each program to call the other routines of the program. D. If you want to use several tasks for different scan periods, put only one program in each task. Remember that each program adds a crossload. So use only one or a few tasks.

This is better



Than this



Action	Details
2. Delete unused tags.	This reduces the size of the tag database. A smaller database takes less time to crossload. To delete unused tags: A. Open one of the tags folders. B. Click *Edit Tags*. C. From the *Show* list, select *Unused*. D. From the *Edit* menu, choose *Select All*. E. Press the [Delete] key.
3. Use arrays and user-defined data types instead of individual tags.	When you create a tag, the controller always sets aside at least 4 bytes (32 bits) of memory. The controller does this even if the tag needs only 1 bit. When you create an array or a user-defined data type, the controller packs smaller data types into 4-byte (32-bit) words. This means the controller has less data to crossload. This array of 32 BOOLs takes only 4-bytes. Tag Name / Alias For / Base Tag / Type ⊞-Bool_Array / / / BOOL[32] The controller crossloads only 4 bytes. These 3 BOOL tags take 12 bytes total (3 tags x 4 bytes/tag = 12 bytes). Tag Name / Alias For / Base Tag / Type Bool_Tag_1 / / / BOOL Bool_Tag_2 / / / BOOL Bool_Tag_3 / / / BOOL The controller crossloads all 12 bytes. Arrays and user-defined data types help you the most with BOOL tags. But also use them for your SINT, INT, DINT, REAL, COUNTER, and TIMER tags.

Action	Details
4. If you've already created individual tags, change them to aliases.	If you've already created individual tags, change them to aliases for elements of an array. Your logic points to the aliases. The controller crossloads the base array.

A. Create an array.

B. Change each individual tag to an alias for an element in the array.

Tag Name	Alias For	Base Tag	Type
⊞-Bool_Array			BOOL[32]
Bool_Tag_1	Bool_Array[0]	Bool_Array[0]	BOOL
Bool_Tag_2	Bool_Array[1]	Bool_Array[1]	BOOL
Bool_Tag_3	Bool_Array[2]	Bool_Array[2]	BOOL

C. Keep pointing your logic to the individual tag names.

5. Keep user-defined data types as compact as possible.

Put like data types together when you lay out a user-defined data type:

- Put all the BOOLs together.
- Put all the SINTs together.
- Put all the INTs together.

This is better

This data type takes 12 bytes. The BOOLs are together.

Members: Data Type Size: 12 byte(s)

	Name	Data Type	Style	Description
	Bool_1	BOOL	Decimal	
	Bool_2	BOOL	Decimal	
	Bool_3	BOOL	Decimal	
	Dint_1	DINT	Decimal	
	Dint_2	DINT	Decimal	
*				

Than this

This data type takes 20 bytes. The BOOLs are spread out.

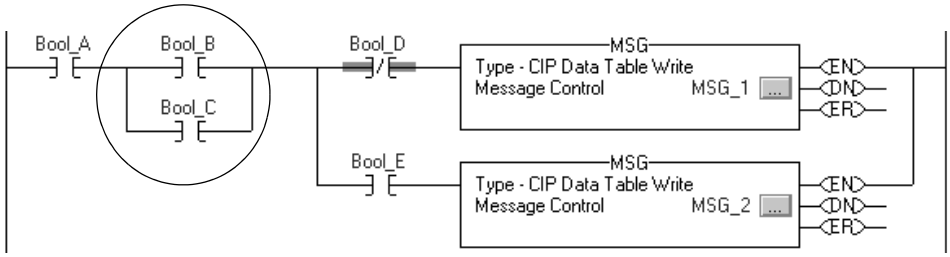
Members: Data Type Size: 20 byte(s)

	Name	Data Type	Style	Description
	Bool_1	BOOL	Decimal	
	Dint_1	DINT	Decimal	
	Bool_2	BOOL	Decimal	
	Dint_2	DINT	Decimal	
	Bool_3	BOOL	Decimal	
*				

Action	Details
6. Keep code as compact as possible.	Avoid checking the same conditions many times. Each instruction adds scan time to your controller.

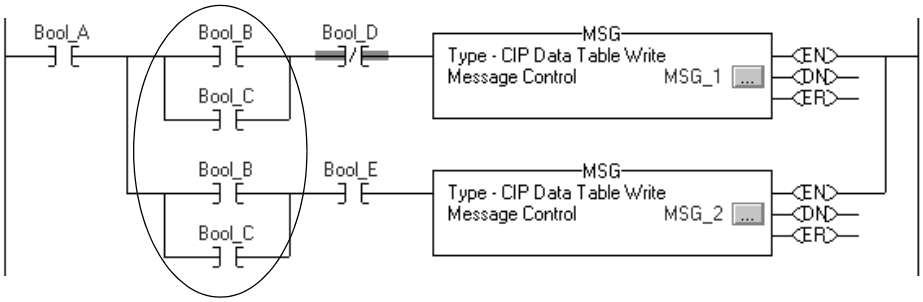
This is better

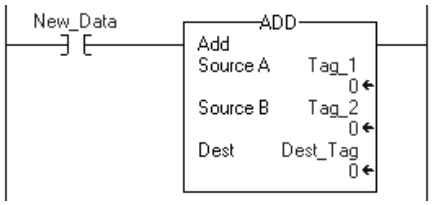
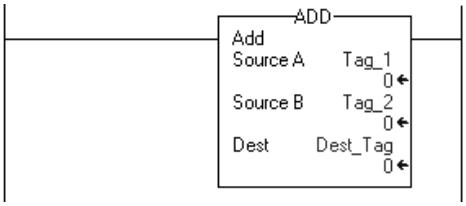
This rung checks *Bool_B* and *Bool_C* only once each scan.

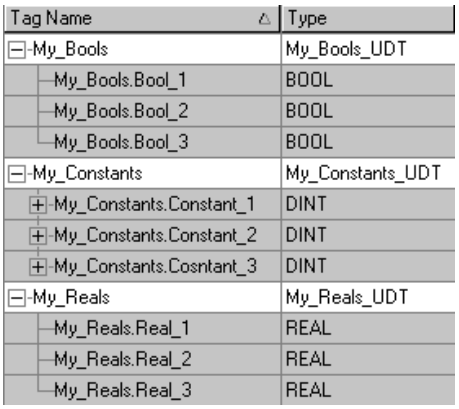
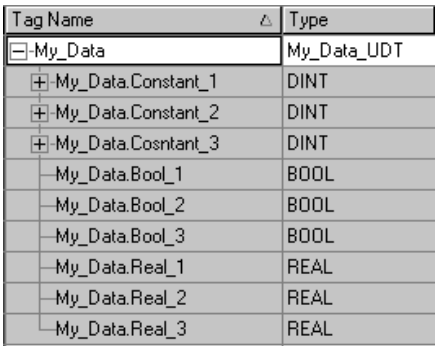


Than this

This rung checks *Bool_B* and *Bool_C* twice each scan. One or two instructions don't add much scan time. But if you do this often, the extra instructions add up to a much longer scan time.



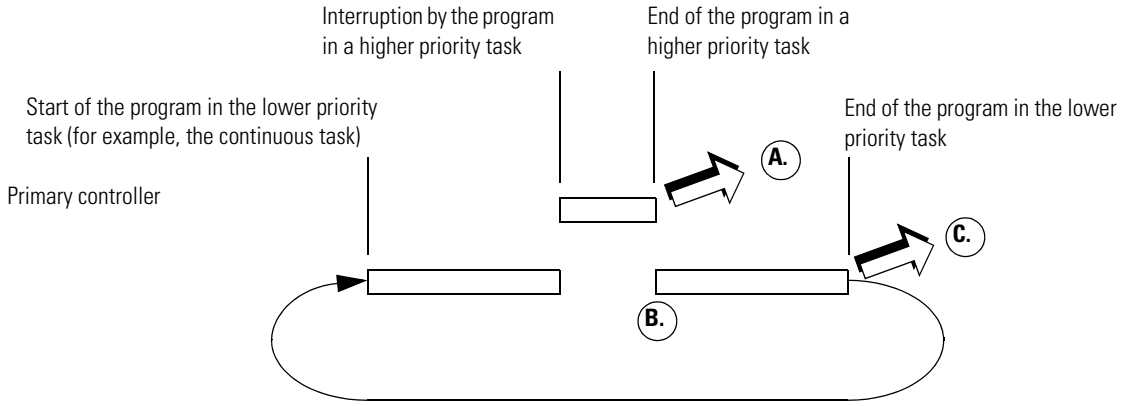
Action	Details
7. Execute code only when you need it.	The controller crossloads a tag anytime an instruction writes a value to the tag. This happens even if the value stays the same: • Many instructions write a value whenever they run. For example, instructions such as OTL, OTU, and many instructions with Destination operands write a value each time the rung-condition-in is true. • Whenever an instruction writes a value, the controller marks the value for the next crossload. This occurs even if the instruction wrote the same value that was previously in the tag. If you execute an instruction only when you need to, you reduce the amount of crossload data. This reduces scan time. To limit the execution of an instruction: • Make a rung false when you don't need to execute its instructions. • Divide your logic into subroutines and call each subroutine only when needed. • Run noncritical code every few scans instead of every scan. This is better The ADD instruction runs only when the controller gets new data (*New_Data* = on). And *Dest_Tag* crossloads only when the ADD instruction produces a new value.  Than this The ADD instruction writes the sum of *Tag_1* + *Tag_2* to *Dest_Tag* each time the rung executes. The controller crossloads *Dest_Tag* every scan, even if *Tag_1* and *Tag_2* stay the same. 

Action	Details
8. Group your data by how often you need it.	To update the secondary controller, the primary controller divides its memory into blocks of 256 bytes. Anytime an instruction writes a value, the primary controller crossloads the entire block that contained the value. For example, if your logic writes only 1 BOOL value to a block, the controller crossloads the entire block (256 bytes). To minimize crossload time, group your data by how often you need it. Suppose that you have some DINTs that you use only as constants to initialize your logic. You have some BOOLs that you update every scan. And you have some REALs that you update every second. This is better One user-defined data type for the BOOLs. The controller crossloads these 4 bytes every scan. One user-defined data type for the DINTs. The controller crossloads these 12 bytes only once. One user-defined data type for the REALs. The controller crossloads these 12 bytes every second.  Than this One user-defined data type for all the data. The controller crossloads these 28 bytes every scan. 
9. Use DINT tags instead of SINT or INT tags	To keep your logic as efficient as possible, use the DINT data type instead of the SINT or INT data types. A ControlLogix controller usually works with 32-bit values (DINTs or REALs). If you use a SINT or INT value: • The controller usually changes a SINT or INT value to a DINT or REAL value before it uses the value. • If the destination is a SINT or INT tag, the controller usually changes the value back to a SINT or INT value. • You don't have to program the controller to change values to or from SINTs or INTs. The controller does it automatically. But it takes extra execution time and memory.

Maintain the Integrity of Your Data During a Switchover

The redundancy system guarantees a bumpless switchover for any logic in the highest priority task. In some cases, a switchover may make lower priority tasks repeat part of their scan. This has to do with how data crossloads from the primary controller to the secondary controller.

As the primary controller executes its logic, it updates the secondary controller at the end of every program.

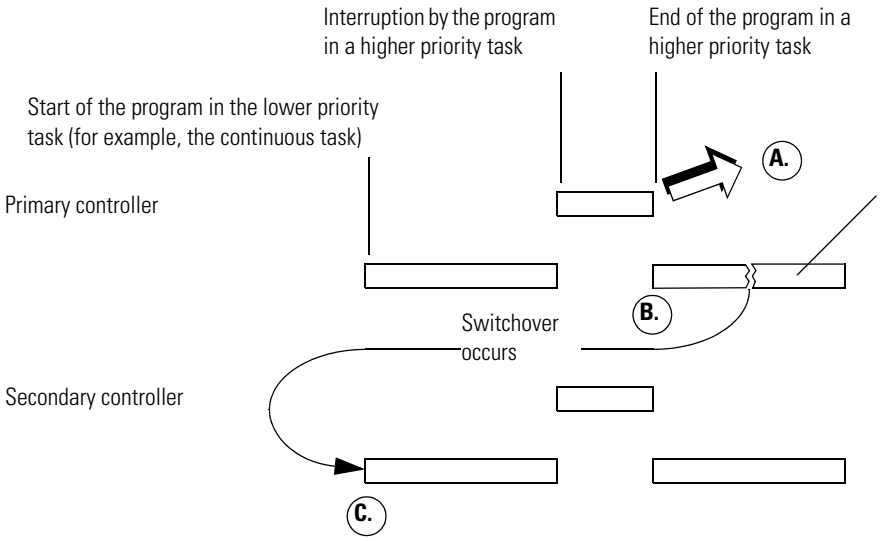

Interruption by the program in a higher priority task
End of the program in a higher priority task
Start of the program in the lower priority task (for example, the continuous task)
End of the program in the lower priority task
Primary controller
A.
B.
C.

A. The following data is sent to the secondary controller:
- Data from the program in the higher priority task
- Data from the first part of the program in the lower priority task

B. Execution returns to the program in the lower priority task.

C. Data from the second part of the program in the lower priority task is sent to the secondary controller.

When a switchover interrupts the execution of the primary controller, the secondary controller reexecutes an interrupted program from the beginning of the program.


Interruption by the program in a higher priority task
End of the program in a higher priority task
Start of the program in the lower priority task (for example, the continuous task)
Primary controller
A.
B.
Switchover occurs
Secondary controller
C.
• This portion of the task is not executed during this scan.
• Instructions executing at the time of the switchover do not complete in this scan.

A. The following data is sent to the secondary controller:
- Data from the program in the higher priority task
- Data from the first part of the program in the lower priority task

B. Execution returns to the program in the lower priority task.

C. The secondary controller:
- starts the scan at the beginning of the program that was in progress in the primary controller during the switchover.
- uses the data from the last update.

In this example, the secondary controller starts the scan with an image of the data as it was during the primary controller's last scan.

To prevent a scan from repeating after a switchover:

- look for array shift instructions.
- look for scan-dependent logic.
- take preventative actions

Look for Array Shift Instructions

The following instructions might corrupt data during a switchover:

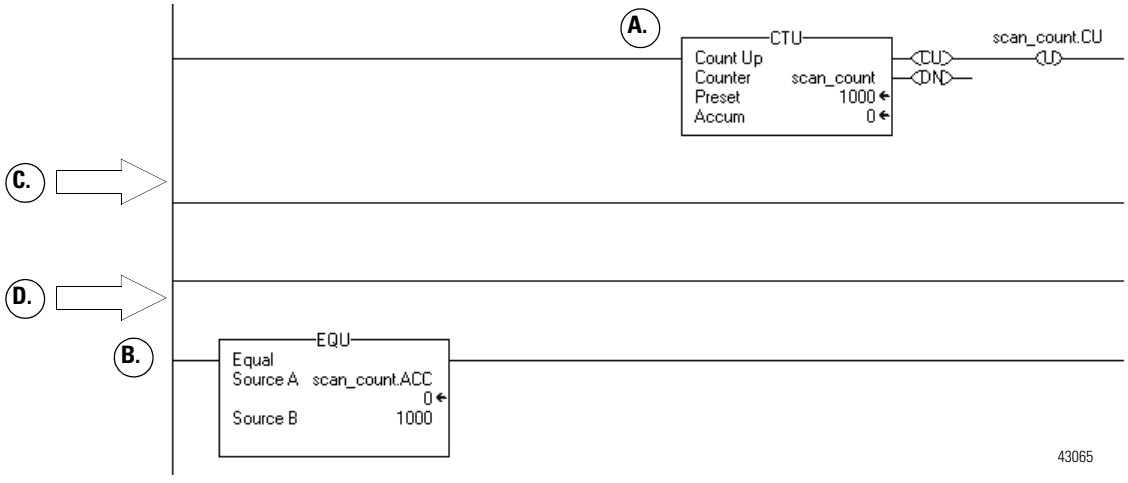
- BSL
- BSR
- FFU

Because these instructions shift data within an array, an interruption by a higher priority task and a subsequent switchover leaves the data with an incomplete shift.

- If a higher priority task interrupts one of these instructions, the partially shifted array values are sent to the secondary controller.
- If a switchover occurs before the instruction completes its execution, data remains only partially shifted.
- The secondary controller starts its execution at the beginning of the program. When it reaches the instruction, it shifts the data again.

Look for Scan-Dependent Logic

A rung that must read the output of another rung during the same scan might miss a scan during a switchover. For example:



A. The CTU instruction counts each scan.

B. The EQU instruction uses the count of each scan (*scan_count.ACC*).

C. If a higher priority task interrupts the logic, the value of *scan_count.ACC* is sent to the secondary controller at the end of the program in the higher priority task.

D. If a switchover occurs before the EQU instruction, the secondary controller starts its execution at the beginning of the program. The EQU instruction misses the last value of *scan_count.ACC*.

Take Preventative Actions

If logic seems susceptible to an upset during a switchover, take one of the following preventative actions:

1. Place susceptible logic in the highest priority task.

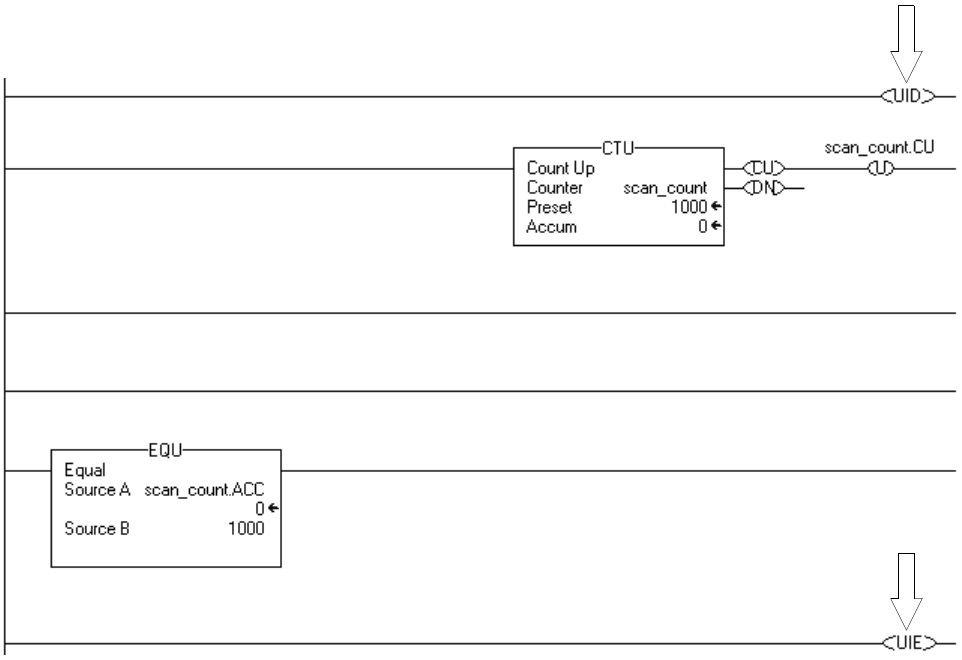
2. If the logic must remain in a lower priority task, take one of the following actions:
   - Use UID and UIE Instruction Pairs.
   - Buffer critical data.

Place Susceptible Logic in the Highest Priority Task

- This prevents the controller from sending any data to the secondary controller until the program finishes.
- If a switchover occurs during the program, the secondary controller repeats the scan using the same starting data.

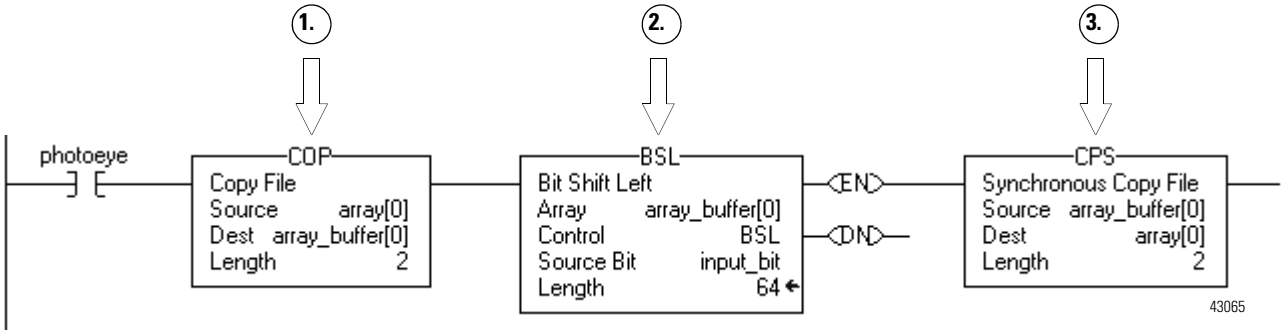
Use UID and UIE Instruction Pairs

Bound critical rungs with UID and UIE instruction pairs. This prevents the higher priority task form interrupting the scan-dependent logic, as shown below:



Buffer Critical Data

The following example shows the use of a buffer together with a BSL instruction.



1. The COP instruction moves the data into a buffer array.
2. The BSL instruction uses the data in the buffer. If a switchover occurs, the source data (*array* tag) remains unaffected.
3. The CPS instruction updates *array* tag. Since higher priority tasks cannot interrupt a CPS instruction, the instruction keeps the integrity of the data.

Determine the Status of Your Redundancy System

Purpose

To write code that determines the status of your redundancy system

When

Perform this procedure to:

- show system status on an HMI screen.
- condition code to execute based on system status.
- get diagnostic information to troubleshoot a system.

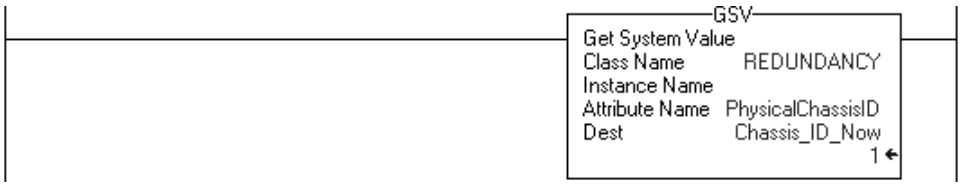
Actions

Use a Get System Value (GSV) instruction to read the attributes of the REDUNDANCY object. See Appendix C for a list of attributes.

Example 1: Ladder Diagram

Get the ID of the primary chassis. The primary chassis always runs the code.

Store the ID in the *Chassis_ID_Now* tag. *Chassis_ID_Now* is a DINT.



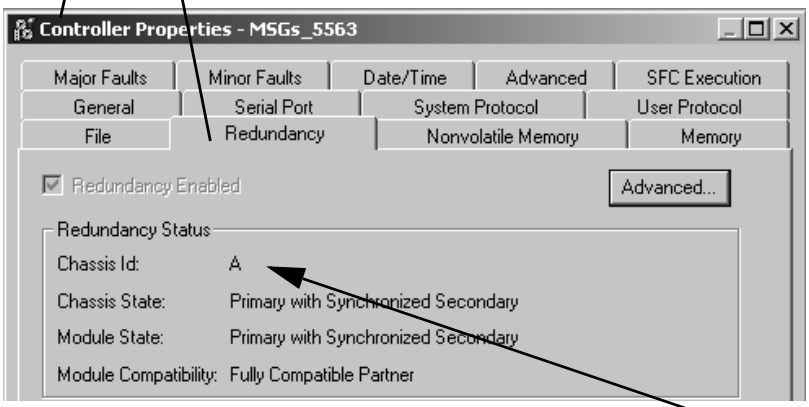
Example 2: Structured Text

```
comment ——— //Get the ID of the primary chassis.
comment ———
comment ——— //That's always the chassis that runs the code.

            //Store the ID in Chassis_ID_Now. Chassis_ID_Now is a DINT.

code    ——— GSV(REDUNDANCY,,PhysicalChassisID,Chassis_ID_Now);
```

Check Your Work

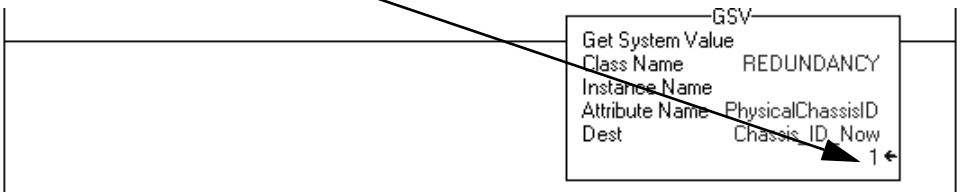
Use the Redundancy tab of the Controller Properties window to check the code attributes. It doesn't show all the attributes, but it shows the more common attributes.

1. Download and run your project.
2. Open the Controller Properties window.
3. Click *Redundancy*.



4. Compare the Redundancy tab with your code.

   In this example, the chassis ID A = 1.



For More Information

For more information on	See
Attributes of the REDUNDANCY object	Appendix C
GSV and SSV instructions	*Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003

Condition Logic to Run After a Switchover

Purpose

To condition a section of your logic to run after a switchover

When

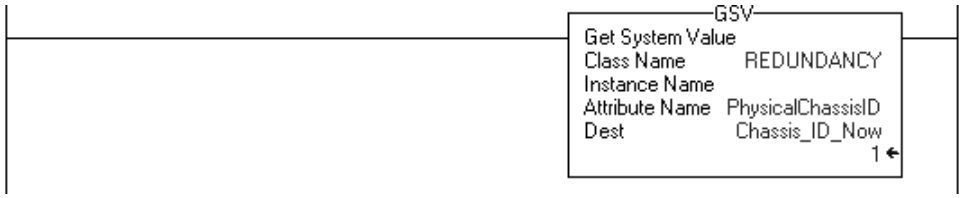
Follow these examples to create logic in preparation for a possible switchover:

Example 1: Ladder Diagram

Get the ID of the primary chassis. That's always the chassis that runs the code.

Store the ID in the *Chassis_ID_Now* tag.

Chassis_ID_Now — DINT.



If this is the first scan then

Set the last value of the chassis ID = the ID of this chassis.

Chassis_ID_Last — DINT.

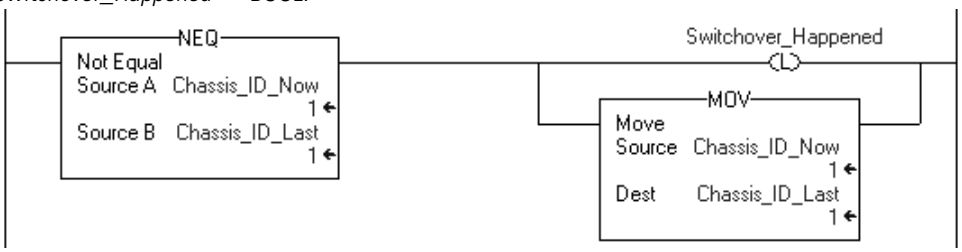
If the chassis ID changes, a switchover happen

ed. If a switchover happens, then

Turn on the *Switchover_Happened* bit.

Set the last value of the chassis ID = the ID of this chassis.

Switchover_Happened — BOOL.

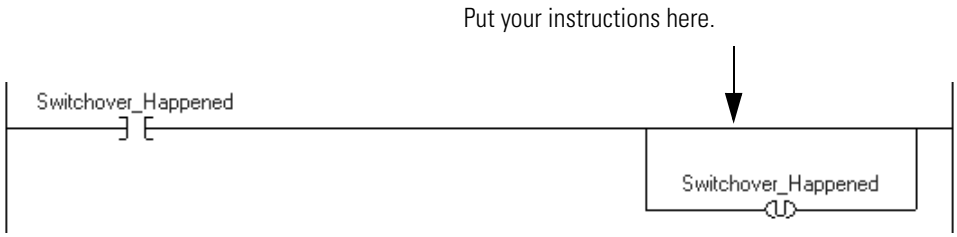


Continued on next page

If Switchover_Happened = on, then

Execute the instructions that you want to execute after a switchover.

Turn off the *Switchover_Happened* bit.



Example 2: Structured Text

```
comment ——— //Get the ID of the primary chassis.
comment ———
comment ——— //That's always the chassis that runs the code.
comment ———
        //Store the ID in Chassis_ID_Now.
        //Chassis_ID_Now -- DINT.
code    ——— GSV(REDUNDANCY,,PhysicalChassisID,Chassis_ID_Now);
        //If this is the first scan
        //Then set the last value of the chassis ID = the ID of this chassis
        //Chassis_ID_Last -- DINT.
        If S:FS then
            Chassis_ID_Last := Chassis_ID_Now;
        End_If;
        //If the chassis ID changes, a switchover happened.
        //If a switchover happens then
        //Turn on the Switchover_Happened bit.
        //Set the last value of the chassis ID = the ID of this chassis
        //Switchover_Happened -- BOOL
```

```
If Chassis_ID_Now <> Chassis_ID_Last then
    Switchover_Happened := 1;
    Chassis_ID_Last := Chassis_ID_Now;
End_If;
```

//If Switchover_Happened = on

//Then

//Execute the instructions that you want to execute after a switchover.

//Turn off the Switchover_Happened bit.

```
If Switchover_Happened then
    Put your statements here.
    Switchover_Happened := 0;
End_If;
```

Send a Message to the SRM

Purpose

To let your logic initiate actions in the SRM

When

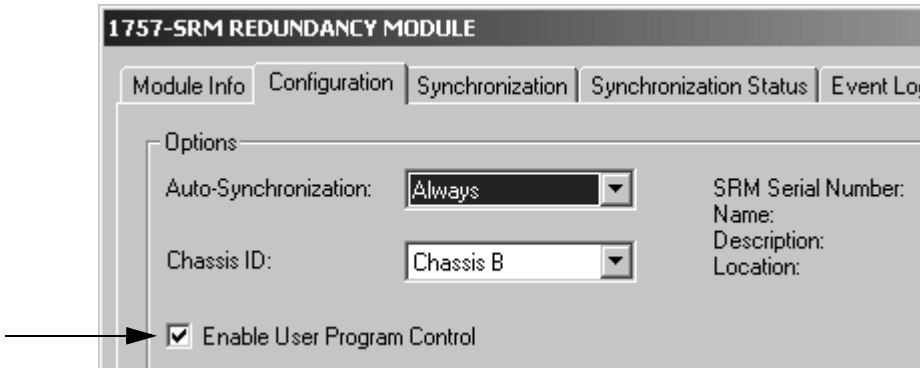
Perform this procedure to:

- initiate a switchover.
- Disqualify the secondary controller.
- Synchronize the secondary controller.
- Set the clock of the SRM module.

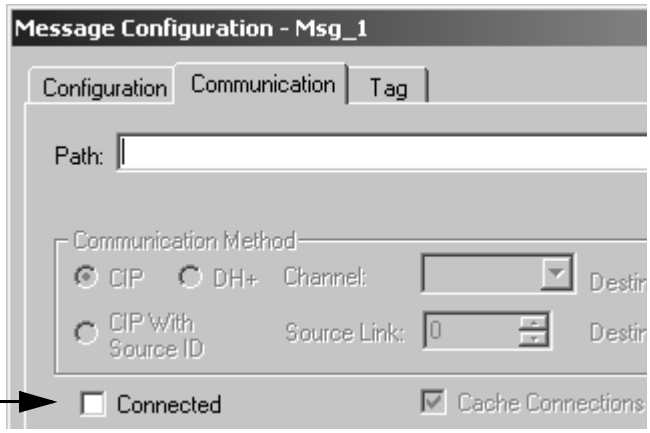
Before You Begin

Before sending a message to an SRM, make sure that:

- the SRM is configured for program control.



- the message is unconnected.



Leave the *Connected* check box clear (unchecked).

Actions

Use the following table to configure a message to an SRM module:

Configuring a Message to an SRM

If you want to	On this tab	For this item	Type or select
initiate a switchover	Configuration	Message Type	CIP Generic
		Service Code	4e
		Class name	bf
		Instance name	1
		Attribute name	leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.
Disqualify the secondary controller	Configuration	Message Type	CIP Generic
		Service Code	4d
		Class name	bf
		Instance name	1
		Attribute name	Leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	Leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.

Configuring a Message to an SRM (Continued)

If you want to	On this tab	For this item	Type or select
Synchronize the secondary controller	Configuration	Message Type	CIP Generic
		Service Code	4c
		Class name	bf
		Instance name	1
		Attribute name	Leave blank
		Source	DINT tag with a value of 1
		Num. Of Elements	4
		Destination	Leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box.	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.
Set the clock of the SRM module	Configuration	Message Type	CIP Generic
		Service Code	10
		Class name	8b
		Instance name	1
		Attribute name	1
		Source	*WallClockTime[0]* where: *WallClockTime* is a DINT[2] array that stores the CurrentValue of the *WALLCLOCKTIME* object.
		Num. Of Elements	8
		Destination	Leave blank
	Communication	Path	1, *slot_number* where: *slot_number* is the left-hand slot number of the 1757-SRM module.
		Connected check box	Leave the *Connected* check box clear (unchecked). You can send only unconnected messages to a 1757-SRM module.

Download the Project to the Primary Controller

You only have to download the project to the primary controller. When the secondary controller is synchronized, the system automatically crossloads the project to the secondary controller.

IMPORTANT If the secondary chassis becomes disqualified after you download the project, make sure that you:

- configured the project for the right type of controller.
- enabled redundancy.

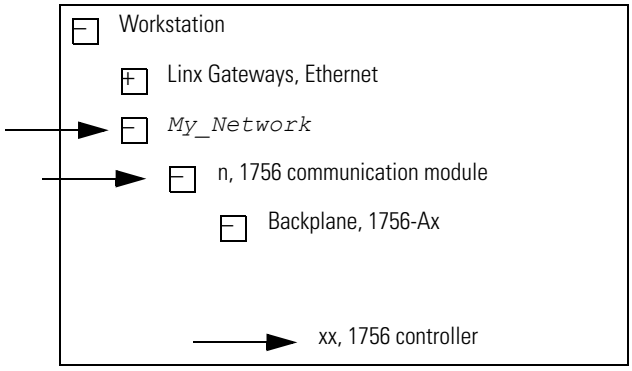
See "Plan for Online Edits" on page 69.

1. Open or create the RSLogix 5000 project for the controller.
2. From the *File* menu, choose *Save*.
3. From the *Communications* menu, choose *Who Active*.
4. Browse to the controller in the primary chassis.

A. Open a branch in one of these ways:
   - Double-click it.
   - Click its + sign.
   - Select it and press the →key.

B. Find the primary chassis. Its communication module uses the address that you gave it.

C. Find the controller.



5. Select the controller and choose *Download*.

   A confirmation box opens.

6. Choose *Download*.

Schedule the ControlNet Networks

IMPORTANT Before you schedule a ControlNet network, turn on the power to both redundant chassis. If you schedule a ControlNet network while the secondary chassis is off, the keeper signature of a CNB module may not match its partner, and the secondary chassis will fail to synchronize.

To schedule a ControlNet network:

- schedule a new network.
- update the schedule of an existing network.
- check the keepers.
- save the project for each controller.

Schedule a New Network

1. Turn on the power to each chassis.
2. Start RSNetworx for ControlNet software.
3. From the *File* menu, choose *New*.
4. From the *Network* menu, choose *Online*.
5. Select your ControlNet network and choose *OK*.
6. Select the *Edits Enabled* check box.
7. From the *Network* menu, choose *Properties*.
8. From *Network Parameters*, type or select the following parameters:

In this box	Specify
Network Update Time	Repetitive time interval in which data is sent over the ControlNet network
Max Scheduled Address	Greatest node number to use scheduled communications on the network
Max Unscheduled Address	Greatest node number that you will use on the network
Media Redundancy	Channels in use
Network Name	Name for the network

9. Choose *OK*.
10. From the *Network* menu, choose *Single Pass Browse*.
11. From the *File* menu, choose *Save*.
12. Type a name for the file that stores the network configuration, then choose *Save*.
13. Select the *Optimize and rewrite Schedule for all Connections* button (default) and choose *OK*.

Update the Schedule of an Existing Network

1. Turn on the power to each chassis.
2. Start RSNetworx for ControlNet software.
3. From the *File* menu, choose *Open*.
4. Select the file for the network and choose *Open*.
5. From the *Network* menu, choose *Online*.
6. Select the *Edits Enabled* check box.
7. From the *Network* menu, choose *Properties*.
8. From *Network Parameters*, update the following parameters:

In this box	Specify
Max Scheduled Address	Greatest node number to use scheduled communications on the network
Max Unscheduled Address	Greatest node number to use on the network

9. Choose *OK*.
10. From the *Network* menu, choose *Single Pass Browse*.
11. From the *File* menu, choose *Save*.
12. Select the *Optimize and rewrite Schedule for all Connections* button and choose *OK*.

Check the Keepers

On a ControlNet network, each keeper must:

- take over the keeper duties if the current keeper drops off the network.
- use the same configuration regardless of which keeper first comes online after a major network disturbance, such as a cable short or system power cycle.

After you schedule your ControlNet networks:

1.		2.
Keeper Capable Node	**Active Keeper**	**Valid Keeper**
offline file	N/A	N/A
01	No	Yes
02	Yes	Yes

1. Make sure the network shows all keeper capable nodes.
2. Make sure that each node is a valid keeper.

For more information, see "Update a Keeper Signature" on page 6.

Save the Project for Each Controller

After your schedule your ControlNet networks, save the online project of each controller. This lets you download a project in the future without having to reschedule the networks.

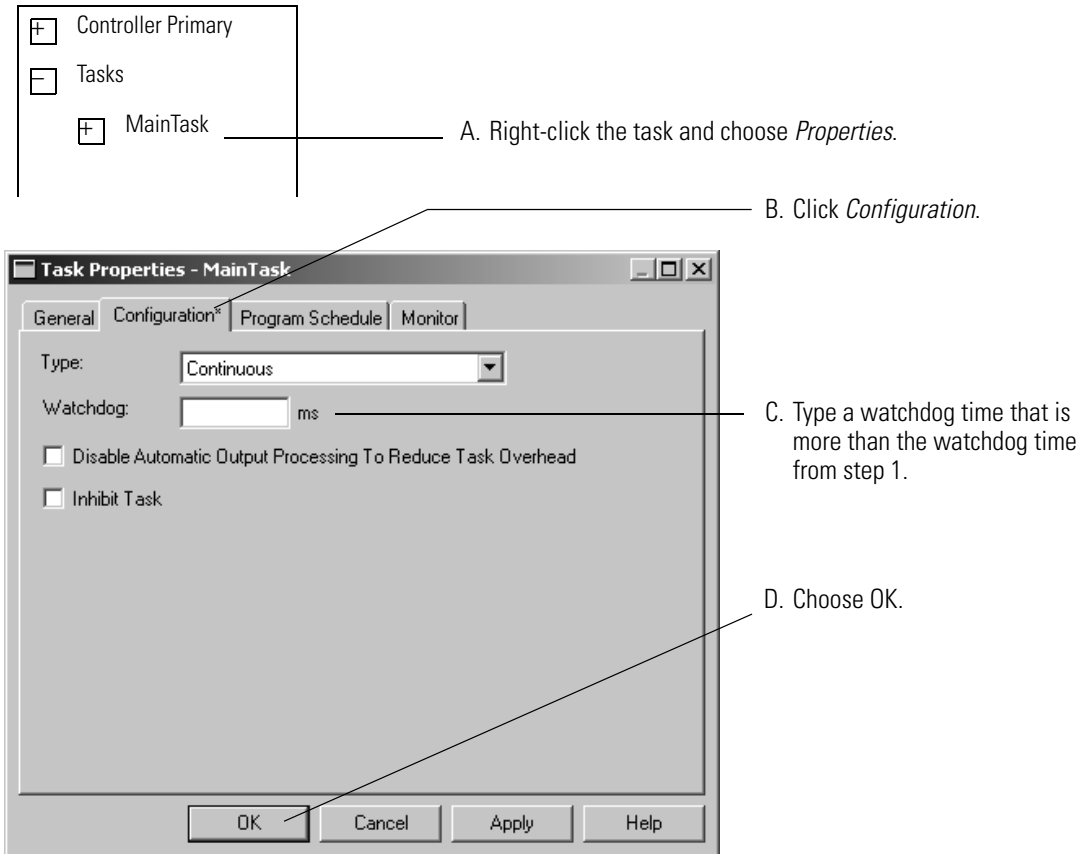
For each controller (redundant and nonredundant) on a ControlNet network:

1. Go online to the controller.
2. Save the project.

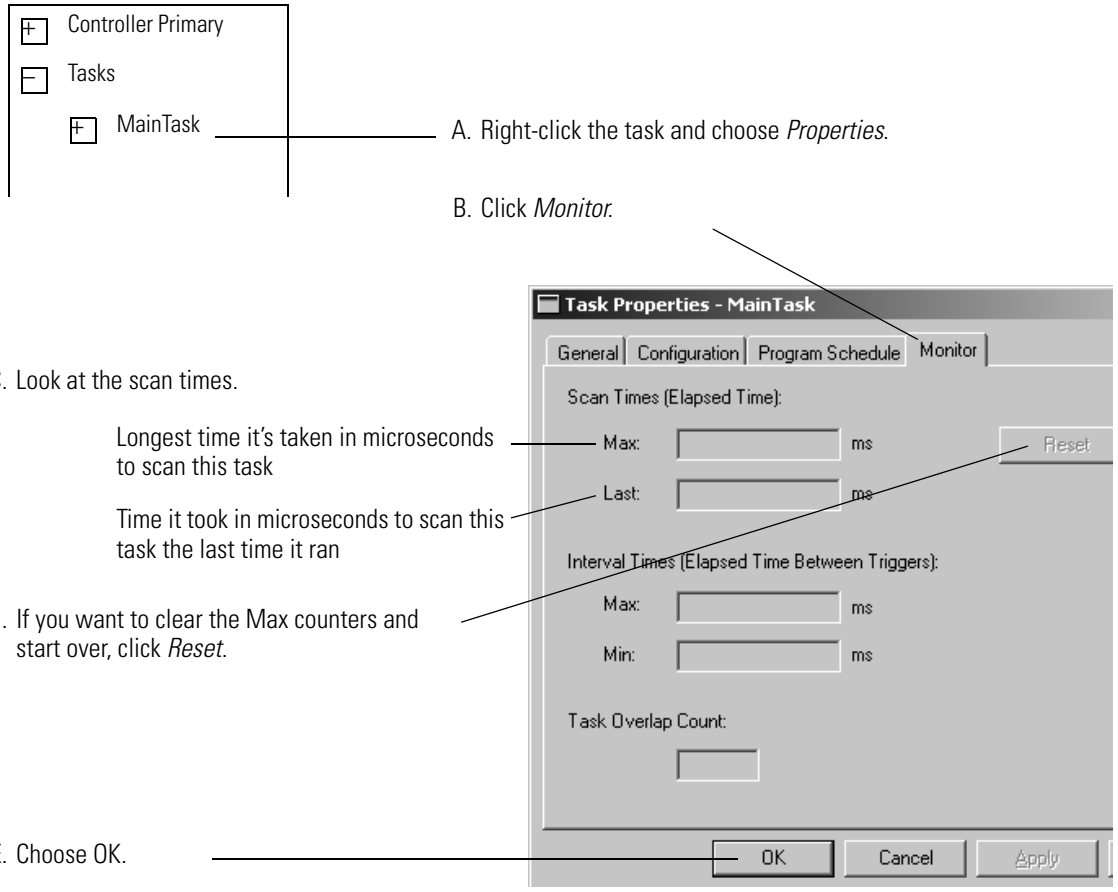
Set the Task Watchdog Times

Give a redundant controller longer watchdog times than a nonredundant controller.

- After a switchover, the secondary controller starts the scan at the beginning of the program that was running in the primary controller at the time of the switchover.
- The watchdog timer for the task that has the program, however, is not reset.
- A major fault happens (type 6, code 1) if the watchdog timer has too little time to completely rescan the program.

Action	Details
1. Set the minimum watchdog time for a task.	Use the following formula to set the minimum watchdog time for a task: Minimum watchdog time = (2 * `maximum_scan_time`) + 150 ms where: `Maximum_scan_time` is the maximum scan time for the entire task when the secondary controller is synchronized.
2. Set the estimated watchdog time for a task.	

Action	Details
3. Determine the real scan time of a task.	Do the following steps while the controller is running.



4. See if the watchdog time is big enough.	A. Calculate the smallest watchdog time for your task using the real scan time of the task: Smallest watchdog time = (2 * `maximum_scan_time`) + 100 ms B. Is your watchdog time more than the smallest watchdog time from step 4A above? • Yes — Stop. Your watchdog time is OK. • No — Repeat step 2 and enter a new watchdog time.

Notes:

Maintain and Troubleshoot the System

When to Use This Chapter

This chapter provides a variety of procedures to commission, upgrade, maintain, and troubleshoot your redundancy system.

Simultaneous power of redundant chassis pair may bump another redundant chassis pair off the EtherNet/IP network	Under the following *combination* of conditions (all must apply), duplicate IP addresses on your EtherNet/IP network will cause you to lose communication with a redundant chassis pair over that EtherNet/IP network: • You have multiple pairs of redundant chassis on the same EtherNet/IP network. For example, pair 1 and pair 2. • The IP addresses of one pair of redundant chassis is the same as another pair of redundant chassis. For example, pair 1 = 10.10.10.10 and pair 2 = 10.10.10.10. • A redundant chassis pair with the conflict (both chassis that make up the pair) simultaneously powers up. For example, both chassis of pair 2 power up at the same time. When this occurs the newly powered up chassis use the IP address. The redundant chassis pair that was previously communicating at that IP address stops communicating on the network. For example, when pair 2 powers up at 10.10.10.10, pair 1 stops communicating on the network.

How to Use This Chapter

If you want to	Then see this section	Page
• Find the cause of an unplanned switchover • Find why secondary chassis became disqualified	Find the Cause of a Switchover or Disqualification	106
Find why the secondary controller fails to synchronize	Troubleshoot a Failure to Synchronize	108
See if the keeper signature of a CNB module is stopping the secondary chassis from synchronizing	Update a Keeper Signature	110
See if a computer is stopping the secondary chassis from synchronizing	See if an Edit Session Is in Progress	111
Look through a log of events to see why system switched over or failed to synchronize	Interpret the SRM Event Log	113
Export specific events from the SRM event log and view them in software such as Microsoft Excel	Export the SRM Event Log	119
Initiate the synchronization process	Manually Synchronize the Chassis	122
• Determine why it takes a very long time to synchronize the secondary controller • Determine why communication with your HMIs is very slow	Optimize Communication	123
• Determine why OPC communication has errored or failed • Determine why you are unable to create tags or edit logic while online	Check the Allocation of Unused Memory	127

If you want to	Then see this section	Page
• Determine the CPU usage of a CNB module • Reduce the CPU usage of a CNB module	Adjust CNB Usage	127
• Store a project to the nonvolatile memory of a controller in a redundant system • Load a project into the controller from the nonvolatile memory of the controller	Store or Load a Project Using Nonvolatile Memory	137
Replace 1756-CNB/D or 1756-CNBR/D module(s) with series E modules	Change CNB modules from Series D to Series E	131
Change the revision of a module while minimizing the time your system is off	Update a Module	140
Store an updated project and firmware to the nonvolatile memory of the controller while the process is running	Store a Project to Nonvolatile Memory While a Process Is Running	139
Update the firmware of a redundant chassis without shutting down the process	Update a System That Is Already at Revision 13	142

Find the Cause of a Switchover or Disqualification

Purpose

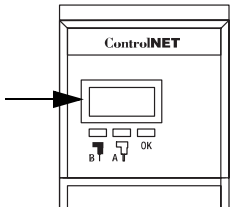
To find and fix the cause of an unplanned switchover or loss of synchronization

When

Perform this procedure when:

- an unplanned switchover happens.
- a chassis that was synchronized becomes disqualified.

Start here.



Actions

1. Do the 1756-CNB/D/E or 1756-CNBR/D/E modules in the primary chassis show PwQS?
   - Yes — Go to Interpret the SRM Event Log on page 113.
   - No — Go to step 2.
2. Does any module in the primary chassis show PwNS?
   - Yes — Go to step 3.
   - No — Go to step 6.

3. Use the following table to troubleshoot the secondary chassis:

If the secondary chassis	And each communication module in the primary chassis	And a secondary communication module has a	Then
Has power	Has a matching partner in the secondary chassis	Red OK light	Replace the module.
		Green OK light	Check the 1757-SRC cable for a proper connection.
	Doesn't have a matching partner in the secondary chassis	⇒	Install a matching module.
Doesn't have power	⇒		Restore the power.

4. Wait several minutes for the system to try to synchronize.

5. What do the CNB modules in the primary chassis show?
   - PwQS — Stop. Your system is synchronized.
   - PwDS — Go to step 6.

6. Use the following table to troubleshoot the secondary chassis:

If the SRM module has a	And a secondary CNB module	And a secondary controller has a	Then
Green OK LED	Doesn't show *NET ERR*	Flashing Red OK light	Clear the major fault of the controller. It's possible that you have to clear the fault on both the primary and secondary controllers.
		Solid Red OK light	A. Cycle the power to the chassis. B. If the OK light remains solid red, replace the controller and flash the controller with the appropriate revision of firmware.
		Solid Green OK light	Go to step 7.
	Shows *NET ERR*	⇒	Check all ControlNet taps, connectors, and terminators for proper connections.
Red OK LED	⇒		A. Cycle the power to the chassis. B. If the OK light of the SRM module remains solid red, contact your local distributor or Rockwell Automation representative.

7. Wait several minutes for the system to try to synchronize.

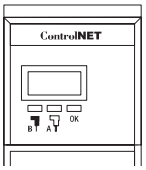
8. Do the CNB modules in the primary chassis show PwQS?
   - Yes — Stop. Your system is synchronized.
   - No — Go to Troubleshoot a Failure to Synchronize on page 108.

Troubleshoot a Failure to Synchronize

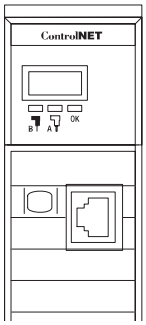
IMPORTANT

- If the steps in this section do not correct the situation, check the usage of the CNB modules. See "Adjust CNB Usage" on page 127.
- If the chassis still doesn't synchronize, try to manually synchronize it. See "Manually Synchronize the Chassis" on page 122.

1. Look at the 1756-CNB/D/E or 1756-CNBR/D/E modules in the primary chassis:

Primary CNB Front panel	If	It means	So do this
Look here. → 	PwQS	Primary with Synchronized (Qualified) Secondary	Stop. The redundant chassis are synchronized.
	PwDS	Primary with Disqualified Secondary	Go to step 2. A problem exists. The redundant chassis are not synchronized.
	PwNS	Primary with No Secondary	

2. Look at the CNB modules in the secondary chassis.

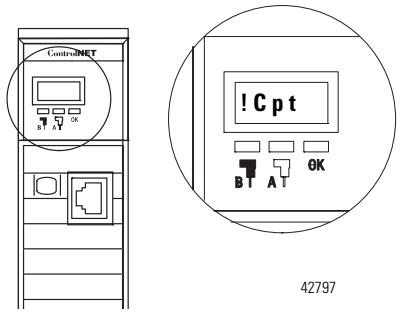
Front panel	If the display shows	Then	So check the following
Secondary CNB 	!Cpt	The CNB modules in the primary and secondary chassis don't match in some way.	1. All CNB modules in each redundant chassis are series D modules. 2. Each CNB module has a partner in the same slot in the other redundant chassis. 3. Each pair of CNB modules (one in each chassis) is set to the same node address. 4. Each module has compatible firmware. 5. All CNB modules in each redundant chassis are valid keepers. See "Update a Keeper Signature" on page 110.
	CMPT	Some module other than this CNB module doesn't match between the primary and secondary chassis.	1. Each module has a partner in the same slot in the other redundant chassis. 2. Each pair of controllers (one in each chassis) has the same memory board (for example, 1756-L55M14). 3. Each module has compatible firmware. 4. The RSLogix 5000 project is configured for the right type of controller and redundancy is enabled. See "Configure a Controller for Redundancy" on page 72. 5. The Module Configuration window for the 1757-SRM module does not list any reasons for the failure to synchronize. See "See if an Edit Session Is in Progress"on page 111.
	DUPL NODE	More than one device on your ControlNet network is using the same node number.	1. No other device on the ControlNet network is set to the address of the CNB modules plus one. For example, if the CNB modules are set to 3, no other device should be set to 4. 2. The 1757-SRCx cable is connected to both SRM modules.
	NET ERR	The ControlNet media is not completely connected.	All ControlNet taps, connectors, and terminators are connected.

Update a Keeper Signature

Purpose

To see if the keeper signature of a CNB module is stopping the secondary chassis from synchronizing

Secondary



When

Perform this procedure when a secondary chassis won't synchronize and its CNB modules show !CPT.

Before You Begin

The secondary chassis won't synchronize if the keeper signature of a CNB module doesn't match its partner. This happens if you schedule the ControlNet network while the secondary chassis is off or if the CNB module was previously configured in a different network.

Actions

1. Start RSNetWorx for ControlNet software.
2. Has this network been scheduled before?

If	Then
No	A. From the *File* menu, select *New*. B. From the *Network* menu, select *Online*. C. Select your ControlNet network and choose *OK*.
Yes	A. From the *File* menu, select *Open*. B. Select the file for the network and choose *Open*. C. From the *Network* menu, select *Online*.

3. From the *Network* menu, choose *Keeper Status*.

4.		5.
Keeper Capable Node	**Active Keeper**	**Valid Keeper**
offline file	N/A	N/A
01	No	No
02	Yes	Yes

4. Make sure the list contains all your keeper capable nodes. This includes the CNB modules in the secondary chassis.

5. Make sure that each node has a valid keeper signature.

If the Valid Keeper column shows	Then
Yes	The node has a valid keeper signature.
No	Select the node and choose *Update Keeper*.

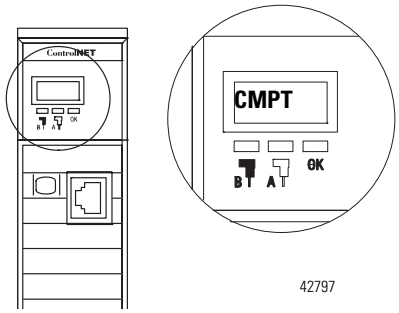
6. Choose *Close*.

See if an Edit Session Is in Progress

Purpose

To see if a computer is stopping the secondary chassis from synchronizing

Secondary

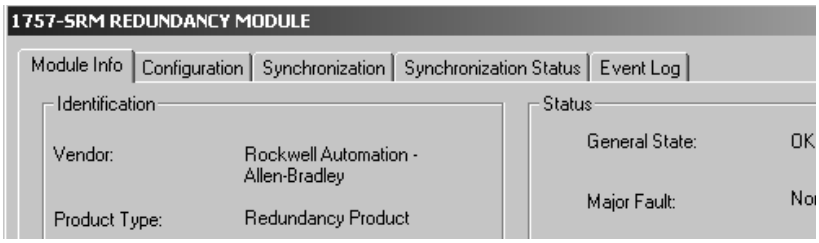


When

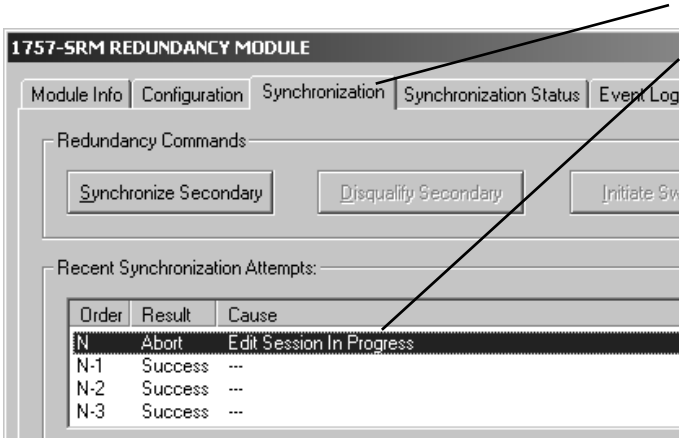
Perform this procedure when a secondary chassis won't synchronize and the CNB modules in the secondary chassis show `CMPT`.

Actions

Actions	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*.



2. Check the recent synchronization attempts.



A. Click *Synchronization*.

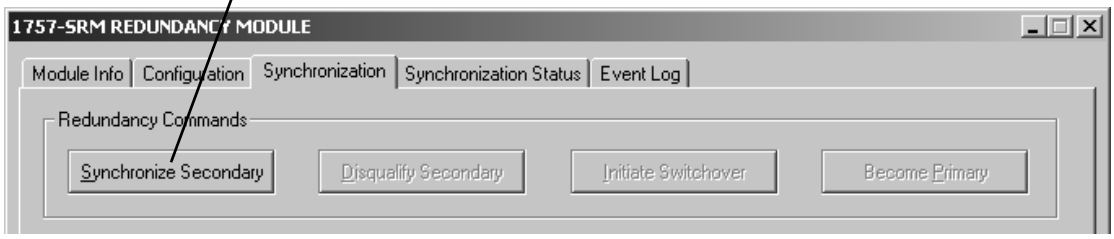
B. Do you see *Edit Session In Progress* under *Recent Synchronization Attempts*?

- Yes — Go to step 3.
- No — An edit session didn't stop synchronization. Return to Troubleshoot a Failure to Synchronize on page 108.

3. Look for the reason.

If	Then
Another computer is editing the project in the controller.	Stop the edit session.
The project contains test edits.	Untest the edits.
The *Nonvolatile Memory Load/Store* dialog box of the controller is open.	Close the *Nonvolatile Memory Load/Store* dialog box.
You tried to synchronize the chassis while downloading a project at the same time.	Wait for the download to finish.

Actions	Details
4. Manually synchronize the chassis.	Choose *Synchronize Secondary* and then *Yes* — continue with synchronization.



Interpret the SRM Event Log

Purpose

To look through a log of events to see why the system switched over or failed to synchronize

When

Perform this procedure when:

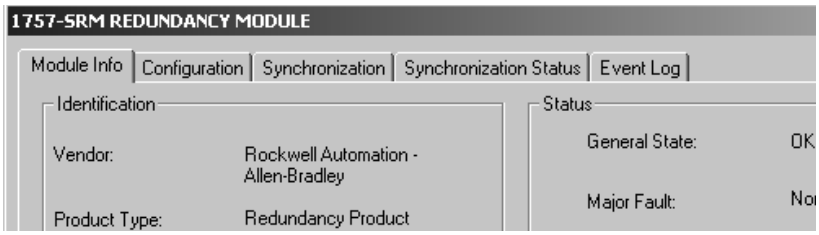
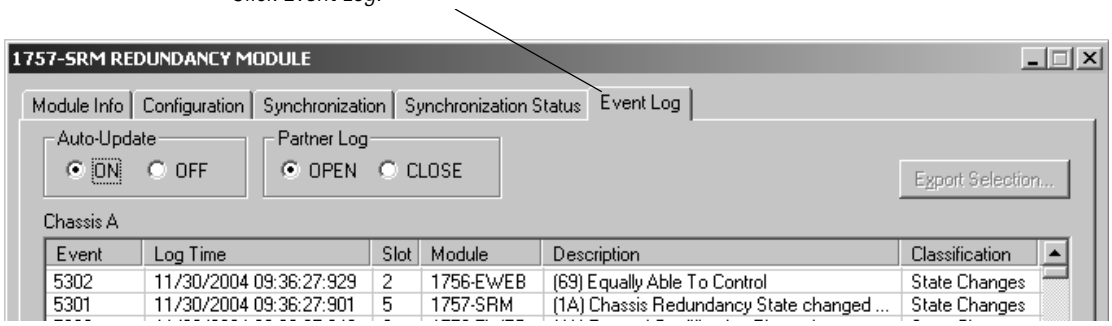
- a switchover happens but your system synchronizes again.
- you've already tried to use the hardware lights to find why your system won't synchronize.

Before You Begin

The SRM clock is accurate only if you:

- initially set it after you installed your system.
- reset it after any power loss to both chassis.

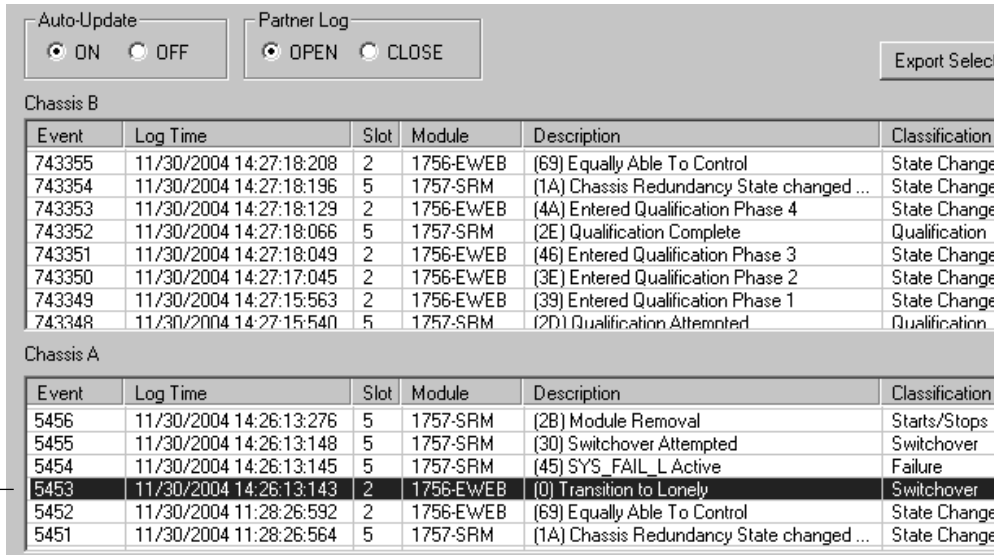
Actions

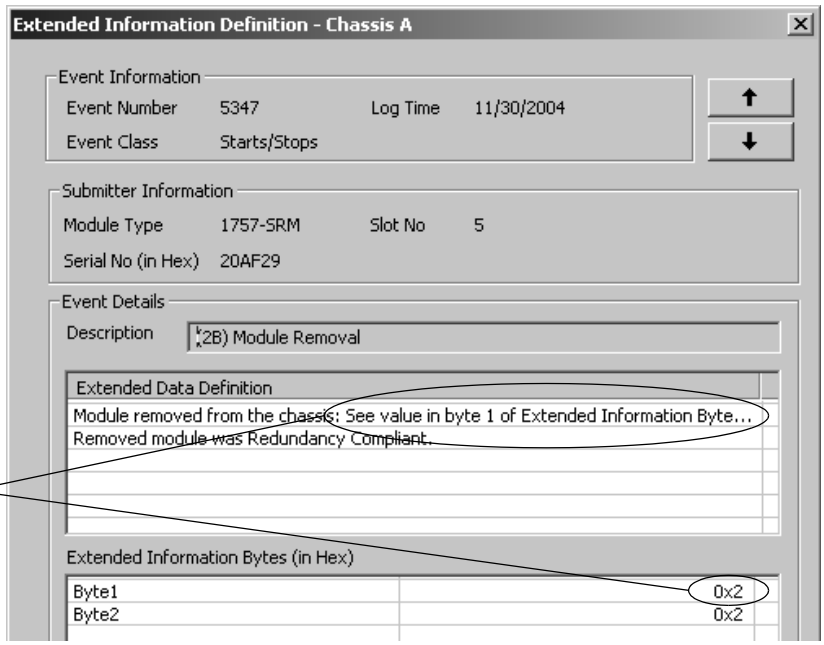
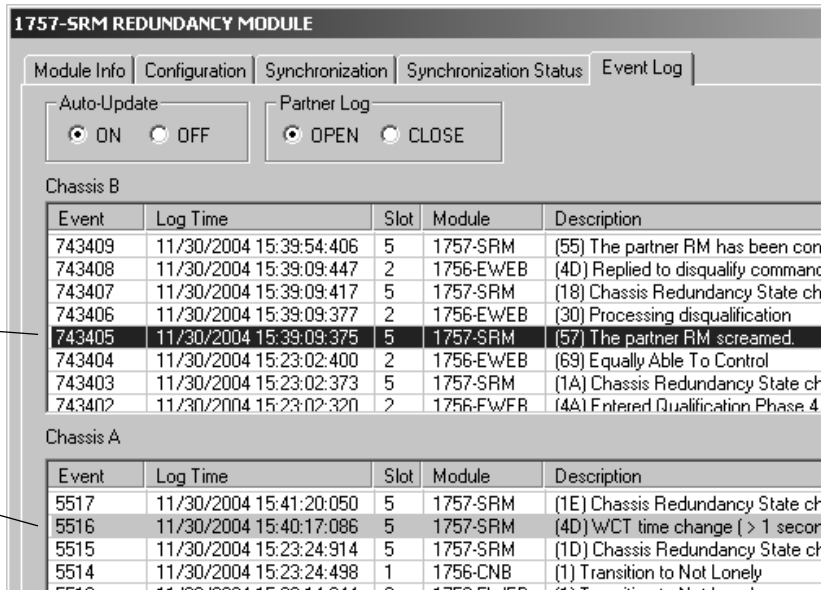
Actions	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the network branches until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 
2. Go to the event log.	Click *Event Log*. 

Actions	Details
3. Look through the events of the secondary chassis for a substantial change in log times.	A. Start with the secondary chassis. • The lower list is the secondary chassis. • The cause of the switchover probably happened to secondary chassis while it was the primary chassis. B. Look for a change of months, days, or hours between the log times of events. • Sometimes the difference is only minutes. • The SRM logs only significant events. It doesn't log events while your system is running normally. C. Use the slot and module columns to find the module that caused the event. D. Go to Interpret SRM events on page 117 to interpret the description. **Example**

Here's a substantial change in the log time.

The slot, module, and description columns show that the 1756-EWEB module in slot 2 went lonely. That usually means it lost its network connection.


Auto-Update
ON
OFF
Partner Log
OPEN
CLOSE
Export Selec
Chassis B
Event | Log Time | Slot | Module | Description | Classification
743355 | 11/30/2004 14:27:18:208 | 2 | 1756-EWEB | (69) Equally Able To Control | State Change
743354 | 11/30/2004 14:27:18:196 | 5 | 1757-SRM | (1A) Chassis Redundancy State changed ... | State Change
743353 | 11/30/2004 14:27:18:129 | 2 | 1756-EWEB | (4A) Entered Qualification Phase 4 | State Change
743352 | 11/30/2004 14:27:18:066 | 5 | 1757-SRM | (2E) Qualification Complete | Qualification
743351 | 11/30/2004 14:27:18:049 | 2 | 1756-EWEB | (46) Entered Qualification Phase 3 | State Change
743350 | 11/30/2004 14:27:17:045 | 2 | 1756-EWEB | (3E) Entered Qualification Phase 2 | State Change
743349 | 11/30/2004 14:27:15:563 | 2 | 1756-EWEB | (39) Entered Qualification Phase 1 | State Change
743348 | 11/30/2004 14:27:15:540 | 5 | 1757-SRM | (2D) Qualification Attempted | Qualification
Chassis A
Event | Log Time | Slot | Module | Description | Classification
5456 | 11/30/2004 14:26:13:276 | 5 | 1757-SRM | (2B) Module Removal | Starts/Stops
5455 | 11/30/2004 14:26:13:148 | 5 | 1757-SRM | (30) Switchover Attempted | Switchover
5454 | 11/30/2004 14:26:13:145 | 5 | 1757-SRM | (45) SYS_FAIL_L Active | Failure
5453 | 11/30/2004 14:26:13:143 | 2 | 1756-EWEB | (0) Transition to Lonely | Switchover
5452 | 11/30/2004 11:28:26:592 | 2 | 1756-EWEB | (69) Equally Able To Control | State Change
5451 | 11/30/2004 11:28:26:564 | 5 | 1757-SRM | (1A) Chassis Redundancy State changed ... | State Change

Actions	Details
4. Double-click and event for more information.	A. Double-click an event to see if it gives more information. The Extended Information Definition dialog opens. B. Click *OK* when you're done to close the Extended Information Definition dialog. **Example**  Someone removed the module for slot 2. Or the module failed.
5. If the secondary log doesn't show the cause, look at the primary log.	Sometimes you have to use both logs to find out what happened. **Example**  A. The secondary log shows that something happened around 15:40. But it's not clear just what happened. B. The primary log shows that around that time the partner SRM screamed. That means it lost power.

Interpret SRM events

Use this table to interpret events recorded in the SRM's event log.

Event description	Meaning
Autoqualification Trigger	Something happened that caused the system to try and synchronize again. Double-click the event to see what happened.
Blank Memories Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the controllers in one chassis don't have projects while the controllers in the other chassis do have projects. In that case, the other chassis becomes primary.
Chassis Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that one chassis has more modules than the other chassis. In that case, the chassis with the most modules gets the first chance to become primary. It becomes primary as long as the other chassis isn't more able to control the system.
Chassis Redundancy State changed to…	The chassis changed to a different redundancy state. • PwQS — Primary with qualified (synchronized) secondary partner • QSwP — Qualified (synchronized) secondary with primary partner • DSwP — Disqualified secondary with primary partner • DSwNP — Disqualified secondary with no partner • PwDS — Primary with disqualified secondary partner • PwNS — Primary with no secondary partner
Crossloading Error	A module isn't able to get some information to its partner.
Disqualified Secondaries Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the modules in one of the chassis powered down in a disqualified secondary state. In that case, the other chassis becomes primary.
Failed Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that a module in one of the chassis is faulted but its partner module in the other chassis isn't faulted. In that case, the other chassis becomes primary.
Firmware Error	The SRM has a problem.
Module Insertion	The SRM now sees the module on the backplane. This means the module has either just powered up, just been put into the chassis, or just finished resetting. Double click the event to see the slot number of the module.
Module Removal	The SRM no longer sees a module on the backplane. This means that the module either experienced a nonrecoverable fault, was removed from the chassis, or was reset. Double-click the event to see the slot number of the module.
Modules Chassis State Rule	A check to choose a primary chassis if both chassis power up at the same time. Suppose that the modules in one chassis are already in a primary state. In that case, that chassis becomes primary.
NRC Modules Rule	A check to choose a primary chassis if both chassis power up at the same time. NRC stands for nonredundancy compliant. Suppose that a module in one of the chassis doesn't support redundancy and all the modules in the other chassis do support redundancy. In that case, the other chassis becomes primary.

Event description	Meaning
Partner not on same CNet link	A primary CNB isn't able to communicate with the secondary CNB over the ControlNet network. This means there is either: • a network problem such as noise, a poor connection, or a problem with the termination. • a secondary CNB that isn't connected to the network.
Powerdown Time Rule	A check to choose a primary chassis if both chassis power up at the same time. If the two chassis powered down more than one second apart, the last chassis to power down gets the first chance at being primary.
Program Fault	A controller has a major fault.
SRM OS Error	The SRM has a problem.
SRM Serial Number Rule	A check to choose a primary chassis if both chassis power up at the same time. This is the final tie-breaker. The SRM with the lower serial number gets the first chance to become primary. It becomes primary as long as the other chassis isn't more able to control the system.
Standby Secondaries Rule	A check to choose a primary chassis if both chassis power up at the same time. Since standby isn't available yet, this check always ends in a tie.
SYS_FAIL_L Active	A module has a nonrecoverable fault or lost its connection to the network. When that happens, the SYS_FAIL signal becomes true. The backplane of the chassis has a SYS_FAIL signal. Each module in the chassis uses this signal to indicate a problem. • The signal is normally false (inactive), which means that all modules in the chassis are OK. • A module turns the SYS_FAIL signal true (active) when the module has a nonrecoverable fault or it losses its connection to the network. Look for later events to find out what happened. • If you see a Module Removal event shortly afterward, then a module has a nonrecoverable fault. Double-click the Module Removal event to see the slot number of the module. The SYS_FAIL signal may stay true until you cycle power or remove the faulted module. • If you see a SYS_FAIL_L Inactive event within a few hundred milliseconds, then a cable is probably disconnected or broken. A communication module pulses the SYS_FAIL signal when the module loses its connection to the network. Look for a Transition to Lonely event to see which module lost its connection.
The partner RM has been connected	The partner SRM powered up or become connected by the fiber-optic cable.
The partner RM screamed	The partner SRM lost power, has an unrecoverable fault, or was removed. An SRM has circuits that hold power long enough for it to send a message to its partner over the fiber-optic interconnect cable. The SRM sends the message even after you remove it from the chassis. This message is called a scream. The scream lets the partner SRM tell the difference between a broken fiber-optic interconnect cable and the power loss or removal of the primary SRM. • If the fiber optic cable breaks, then there isn't a switchover. • If the SRM loses power or is removed, then there is a switchover.

Event description	Meaning
Transition to Lonely	A communication module doesn't see any other devices on its network. This usually means that the network cable of the module is disconnected or broken. The event log shows Transition to Not Lonely when you reconnect the cable.
Unknown Event	The SRM configuration tool doesn't have a description for the event.
WCT time change (> 1 second)	The clock of the SRM changed. This happens when you: • use the SRM configuration tool to set the clock. • connect the SRM to another SRM that is already primary. The SRM synchronizes its clock to that of the primary SRM.

Export the SRM Event Log

Purpose

To export specific events from the SRM event log to a CSV or TXT file

When

Perform this procedure to:

- look at the event log in spreadsheet software such as Microsoft Excel.
- send the event log to someone else.

Before You Begin

The SRM configuration tool lets you export events from both the primary and the secondary chassis at the same time.

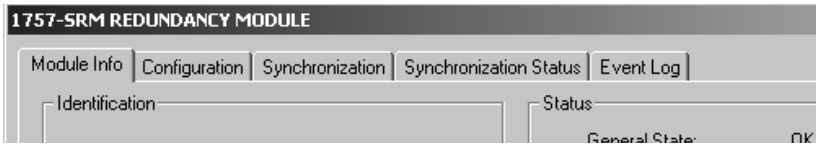
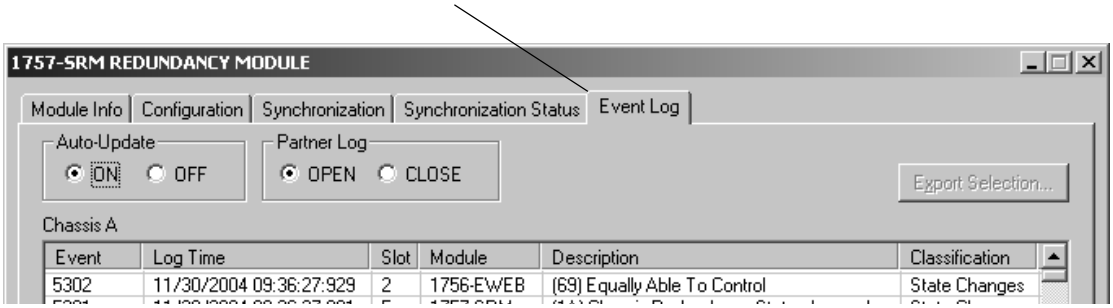
Chassis ID	Event	Log Time	Slot	Module	Description
Chassis B	743584	12/2/2004 16:02:27:055	2	1756-EWEB	(69) Equally Able To Control
Chassis B	743583	12/2/2004 16:02:27:050	5	1757-SRM	(1A) Chassis Redundancy State ch
Chassis B	743582	12/2/2004 16:02:26:967	2	1756-EWEB	(4A) Entered Qualification Phase 4
Chassis B	743581	12/2/2004 16:02:26:917	5	1757-SRM	(2E) Qualification Complete
Chassis A	5720	12/3/2004 14:18:43:894	5	1757-SRM	(C) Port2 Communication error
Chassis A	5719	12/2/2004 16:02:27:052	5	1757-SRM	(1E) Chassis Redundancy State ch

IMPORTANT

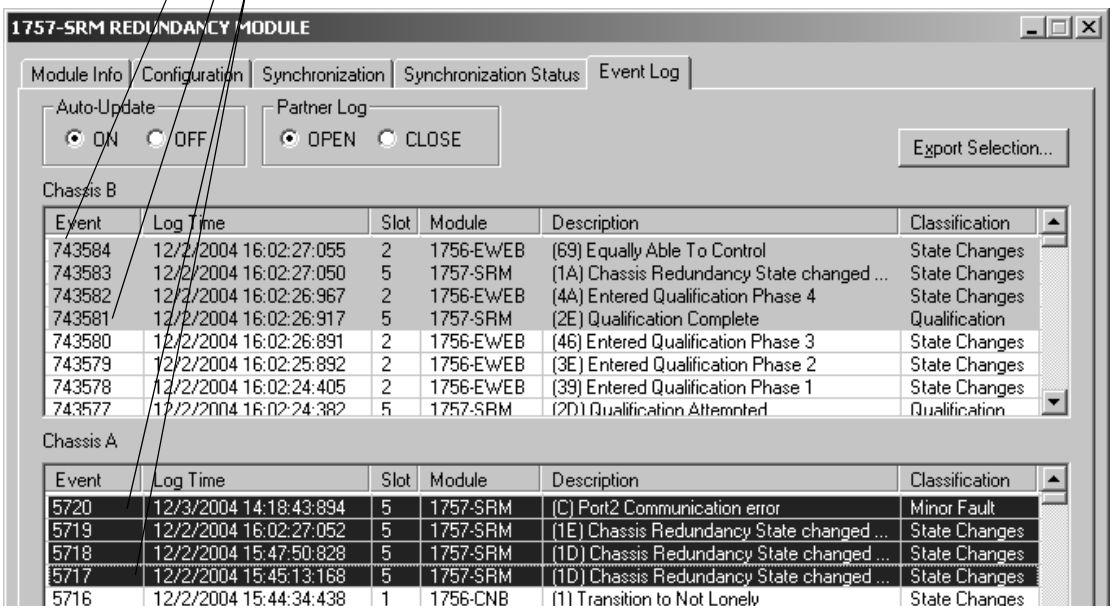
When you send event logs to Rockwell Automation:

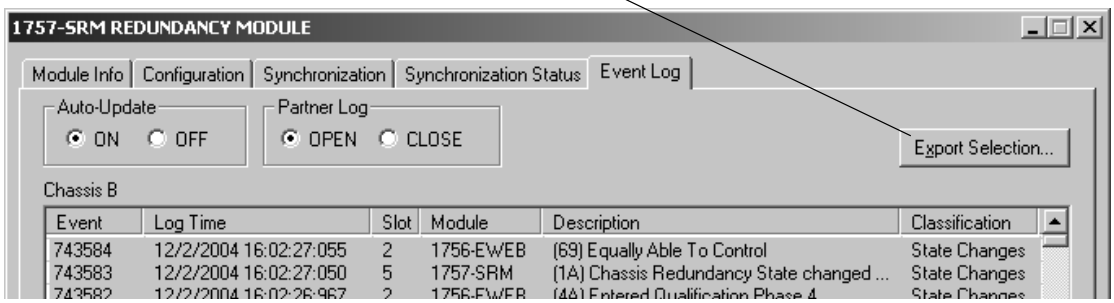
- send events from both the primary and secondary chassis.
- include all events from the latest event to the last event when you knew that the chassis were in a good state.

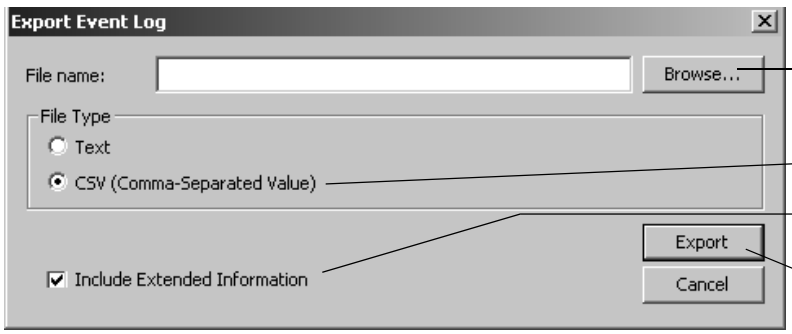
Actions

Action	Details
1. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 
2. Go to the event log.	Click *Event Log*. 

Action	Details
3. Select the events that you want to export.	A. Click the first event that you want to export from the primary chassis. B. Press and hold the [Shift] key and then click the last event that you want to export from the primary chassis. C. Repeat steps 3A and 3B for the secondary chassis.
4. Export your selection.	A. Choose *Export Selection*.


1757-SRM REDUNDANCY MODULE
Module Info
Configuration
Synchronization
Synchronization Status
Event Log
Auto-Update
ON
OFF
Partner Log
OPEN
CLOSE
Export Selection...
Chassis B
Event | Log Time | Slot | Module | Description | Classification
743584 | 12/2/2004 16:02:27:055 | 2 | 1756-EWEB | (69) Equally Able To Control | State Changes
743583 | 12/2/2004 16:02:27:050 | 5 | 1757-SRM | (1A) Chassis Redundancy State changed ... | State Changes
743582 | 12/2/2004 16:02:26:967 | 2 | 1756-EWEB | (4A) Entered Qualification Phase 4 | State Changes
743581 | 12/2/2004 16:02:26:917 | 5 | 1757-SRM | (2E) Qualification Complete | Qualification
743580 | 12/2/2004 16:02:26:891 | 2 | 1756-EWEB | (46) Entered Qualification Phase 3 | State Changes
743579 | 12/2/2004 16:02:25:892 | 2 | 1756-EWEB | (3E) Entered Qualification Phase 2 | State Changes
743578 | 12/2/2004 16:02:24:405 | 2 | 1756-EWEB | (39) Entered Qualification Phase 1 | State Changes
743577 | 12/2/2004 16:02:24:382 | 5 | 1757-SRM | (2D) Qualification Attempted | Qualification
Chassis A
Event | Log Time | Slot | Module | Description | Classification
5720 | 12/3/2004 14:18:43:894 | 5 | 1757-SRM | (C) Port2 Communication error | Minor Fault
5719 | 12/2/2004 16:02:27:052 | 5 | 1757-SRM | (1E) Chassis Redundancy State changed ... | State Changes
5718 | 12/2/2004 15:47:50:828 | 5 | 1757-SRM | (1D) Chassis Redundancy State changed ... | State Changes
5717 | 12/2/2004 15:45:13:168 | 5 | 1757-SRM | (1D) Chassis Redundancy State changed ... | State Changes
5716 | 12/2/2004 15:44:34:438 | 1 | 1756-CNB | (1) Transition to Not Lonely | State Changes


1757-SRM REDUNDANCY MODULE
Module Info
Configuration
Synchronization
Synchronization Status
Event Log
Auto-Update
ON
OFF
Partner Log
OPEN
CLOSE
Export Selection...
Chassis B
Event | Log Time | Slot | Module | Description | Classification
743584 | 12/2/2004 16:02:27:055 | 2 | 1756-EWEB | (69) Equally Able To Control | State Changes
743583 | 12/2/2004 16:02:27:050 | 5 | 1757-SRM | (1A) Chassis Redundancy State changed ... | State Changes



B. Click the Browse button and choose a location and name for the export file.

C. Choose *CSV (Comma-Separated Value)*.

D. Select the *Include Extended Information* check box.

E. Choose *Export*.

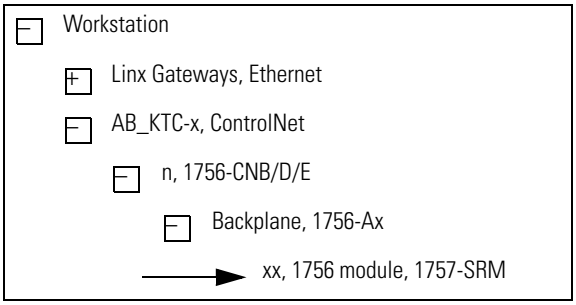
Manually Synchronize the Chassis

After a switchover, you may have to manually synchronize the chassis because either:

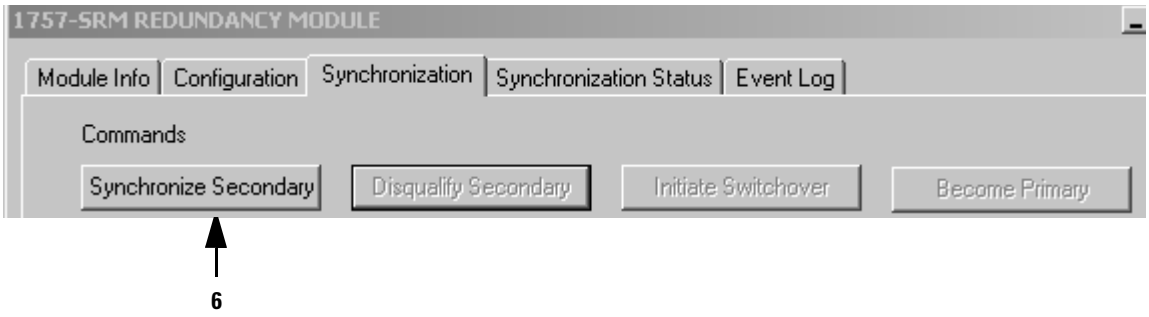
- the *Auto-Synchronization* option is not set to *Always* or
- the chassis failed to synchronize.

To manually synchronize the chassis:

1. Display RSLinx software.
2. From the *Communications* menu, choose *RSWho*.
3. Expand the network until you see the 1757-SRM module in the primary chassis.

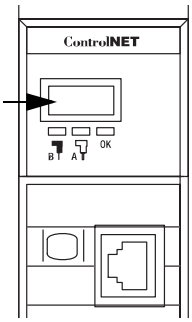


4. Right-click the 1757-SRM module and select *Module Configuration*.
5. Click *Synchronization*.



6. Choose *Synchronize Secondary* and then choose *Yes* to confirm.
7. Choose *OK*.

8. In the primary chassis, what do the CNB modules display?

Front panel	If you see	Which means	Then
Look here. 	PwQg	Primary with Synchronizing (Qualifying) Secondary	• Synchronization is in progress. • Continue waiting. It may take several minutes to synchronize the secondary chassis.
	PwQS	Primary with Synchronized (Qualified) Secondary	• The secondary chassis is synchronized. • Skip the remaining steps in this section.
	PwDS	Primary with Disqualified Secondary	• The secondary chassis is *NOT* synchronized. • Go to step 9.

9. Cycle power to the secondary chassis.

10. If the CNB module in the primary chassis fails to display *PwQS,* see "Troubleshoot a Failure to Synchronize" on page 108.

Optimize Communication

If it takes too long to synchronize the secondary chassis or update your HMI, there may not be enough controller time for unscheduled communication. In general, unscheduled communication is any type of communication that you do not configure through the I/O configuration folder of the controller:

This type of communication	Is
Update I/O data (not including block-transfers)	Scheduled communication
Produce or consume tags	
Communicate with programming devices (for example, RSLogix 5000 software)	Unscheduled communication
Communicate with HMI devices	
Execute Message (MSG) instructions, including block-transfers	
Respond to messages from other controllers	
Synchronize the secondary controller of a redundant system	
Reestablish and monitor I/O connections, such as Removal and Insertion Under Power conditions; this does not include normal I/O updates that occur during the execution of logic.	
Bridge communications from the serial port of the controller to other ControlLogix devices via the ControlLogix backplane	

To speed up unscheduled communication:

If an RSLogix 5000 project contains	Then	See Page
Only a continuous task and no other tasks (This is the default task configuration.)	Choose a Greater System Overhead Time Slice	124
More than one task (for example, at least 1 periodic task)	Make All Your Tasks Periodic	126

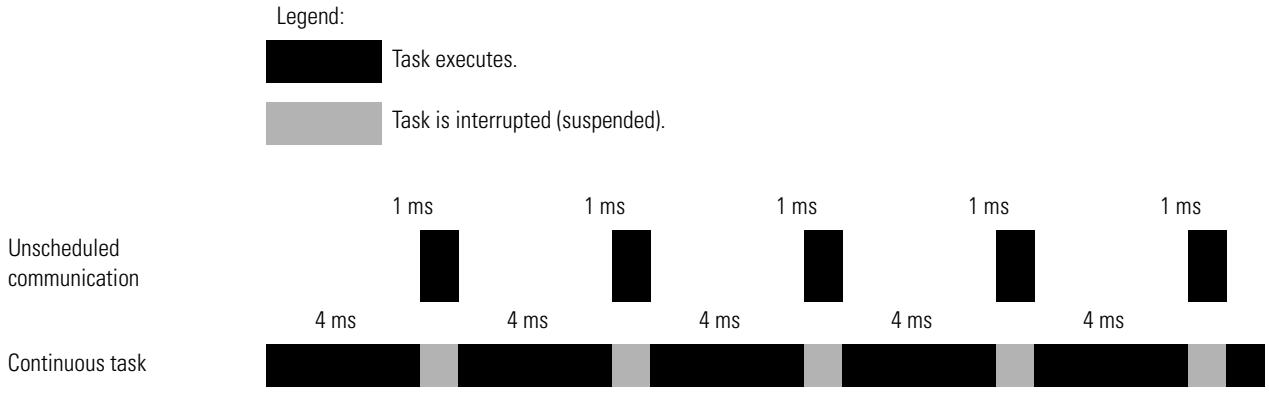
Choose a Greater System Overhead Time Slice

The system overhead time slice specifies the percentage of time (excluding the time for periodic tasks) that the controller devotes to unscheduled communication. The controller performs unscheduled communication for up to 1 ms at a time and then resumes the continuous task.

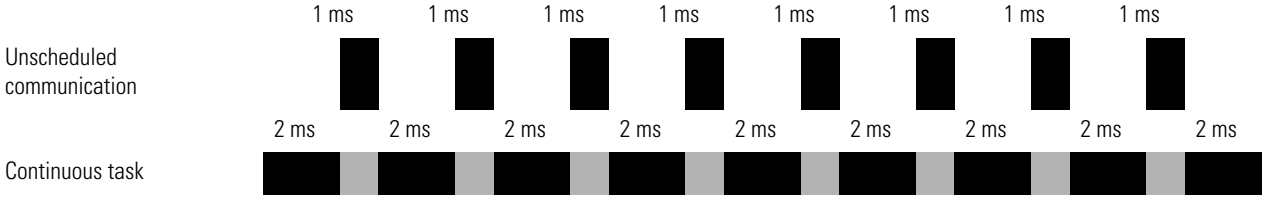
The following table shows the ratio between the continuous task and unscheduled communication at various system overhead time slices:

At this time slice	The continuous task runs for	And unscheduled communication occurs for up to
10%	9 ms	1 ms
20%	4 ms	1 ms
33%	2 ms	1 ms
50%	1 ms	1 ms

At a system overhead time slice of 20 % (default), unscheduled communication occurs every 4 ms of continuous task time for 1 ms.

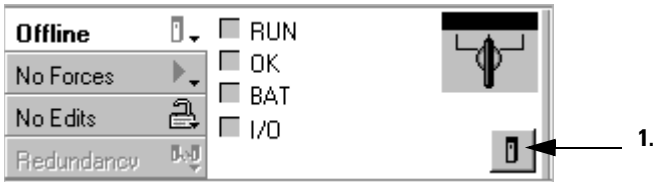


If you increase the system overhead time slice to 33 %, unscheduled communication occurs every 2 ms of continuous task time for 1 ms.

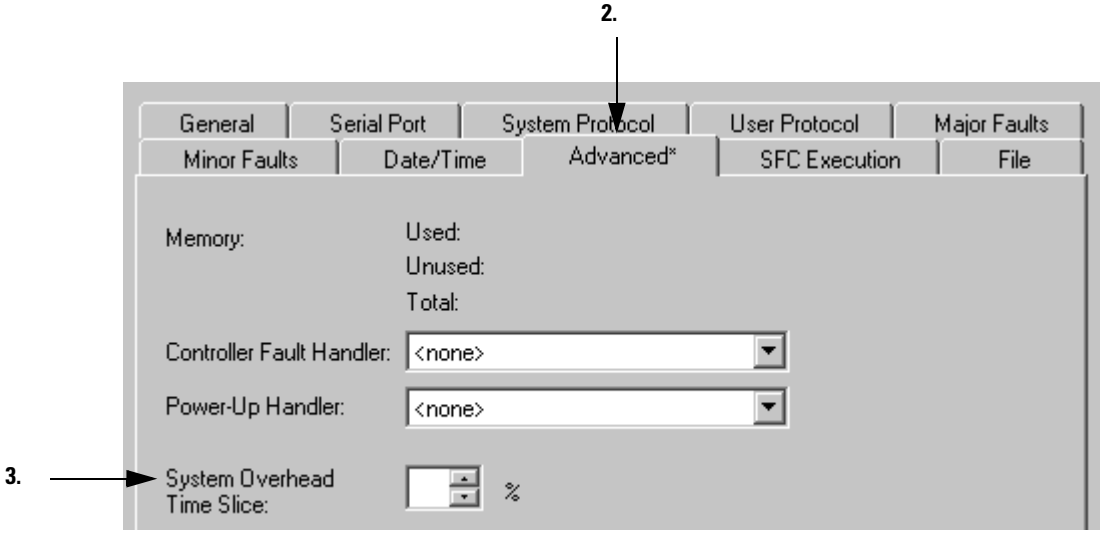


Enter a System Overhead Time Slice

To change the system overhead time slice:

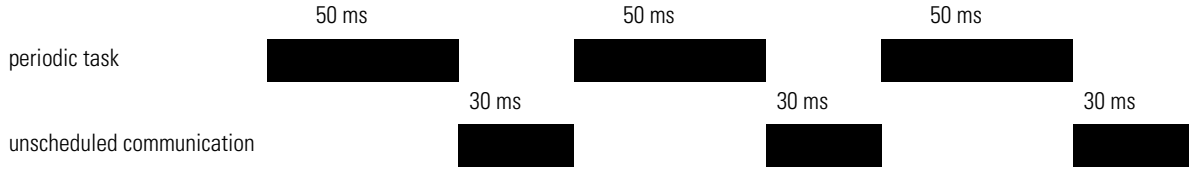


1. On the Online toolbar, click controller properties button.
2. Click *Advanced*.



3. Type or select a value for the system overhead time slice.
4. Choose OK

Make All Your Tasks Periodic

Action	Details
1. If you have more than one task, make them all periodic tasks.	If the controller contains only a periodic task or tasks, the system overhead time slice value has no effect. Unscheduled communication happens whenever a periodic task is not running. Example Suppose your task takes 50 ms to execute and you configure its period to 80 ms. In that case, the controller has 30 ms out of every 80 ms for unscheduled communication. 
2. Follow these guidelines to set the periods of the tasks.	If you have multiple tasks, make sure that: 1. The execution time of a highest priority task is significantly less than its period. 2. The total execution time of all your tasks is significantly less than the period of the lowest priority tasks. This generally leaves enough time for unscheduled communication. For example, in this configuration of tasks:

Task	Priority	Execution time	Rate
1	higher	20 ms	80 ms
2	lower	30 ms	100 ms
	total execution time:	50 ms	

1. The execution time of the highest priority task (Task 1) is significantly less than its period (20 ms is less than 80 ms).

2. The total execution time of all tasks is significantly less than the period of the lowest priority task (50 ms is less than 100 ms).

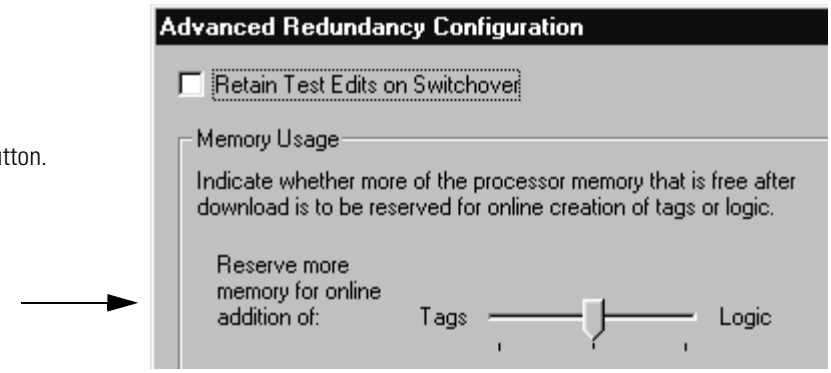
3. Tune the periods of the tasks.	Adjust the periods of the tasks as needed to get the best trade-off between executing your logic and servicing unscheduled communication.
4. Look for overlaps.	Look at the *Monitor* tab of the properties of the task to see if overlaps are happening. An overlap happens if the period of a task is less than its scan time. If you see overlaps, increase the period of the task.

Check the Allocation of Unused Memory

The controller reserves a specific amount of its unused memory for tags and the rest for logic. Depending on how you configure the memory usage, you might not have memory for the required operation.

To display this dialog box:

1. Choose *Edit* ⇒*Controller Properties*.
2. On the *Redundancy* tab, choose the *Advanced* button.


Advanced Redundancy Configuration
Retain Test Edits on Switchover
Memory Usage
Indicate whether more of the processor memory that is free after download is to be reserved for online creation of tags or logic.
Reserve more memory for online addition of:
Tags
Logic

If	Then	Important
You are unable to perform online edits		
OPC communications error or fail	Make sure the slider is not all the way to *Tags*.	You are able to change this setting only while: • offline. • online in program mode.
You are unable to create tags while online	Make sure the slider is not all the way to *Logic*.	

Adjust CNB Usage

For each CNB module in a redundant chassis, keep CPU usage to less than 75 percent.

- Each redundant CNB module needs enough additional processing time for redundancy operations.
- At peak operations such as synchronization, redundancy uses an additional 8 percent (approximately) of the CPU of the CNB module.
- A total CPU usage that is higher than 75 percent may prevent a secondary chassis from synchronizing after a switchover.

To reduce the CPU usage of a module, take any of the following actions:

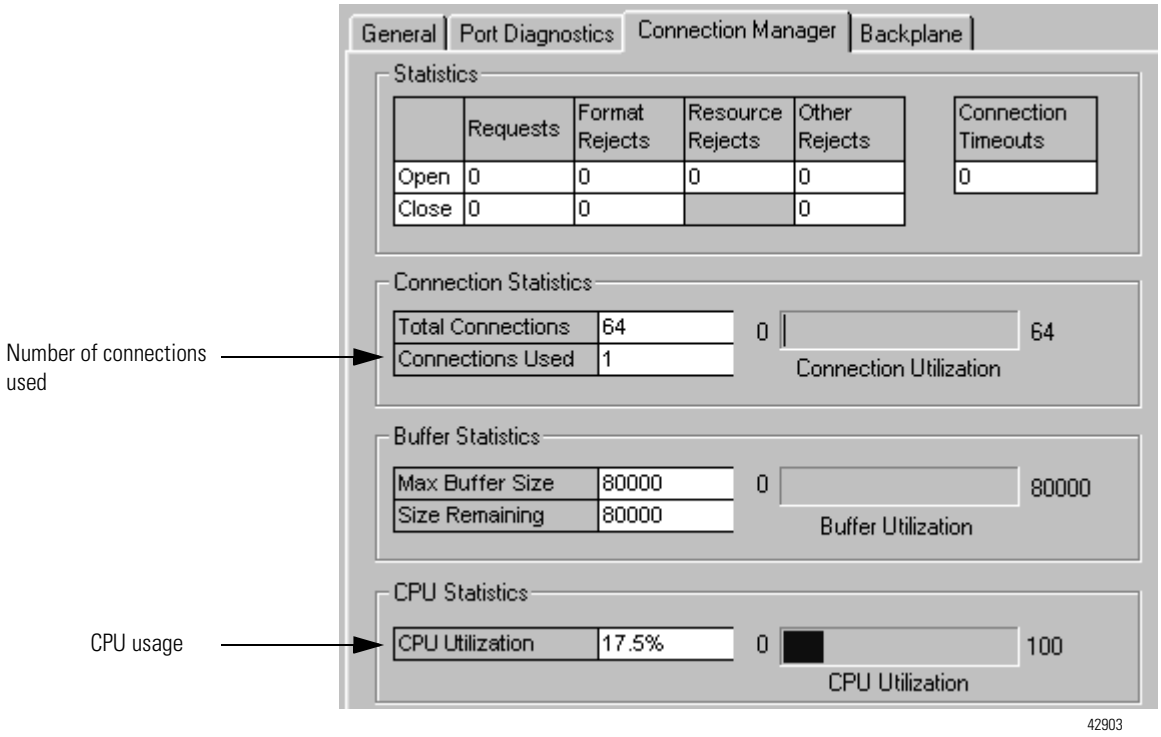
- Change the network update time (NUT) of the ControlNet network (Typically, increase the NUT to reduce the CPU usage of a CNB module.)
- Increase the requested packet interval (RPI) of your connections.
- Reduce the number of connections to (through) the CNB.
- Reduce the number of MSG instructions.
- Add another CNB module to each redundant chassis.

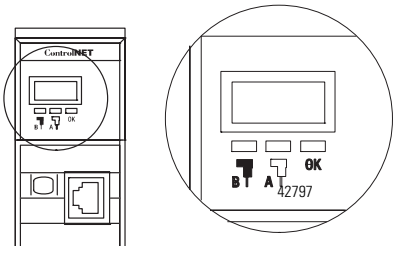
To obtain status information about a CNB module:

- use RSLinx software.
- look at the four-character display.
- send a message to the CNB module.

Use RSLinx Software

1. Start RSLinx software.
2. Expand a network until the CNB module appears.
3. Right-click the module and choose *Module Statistics*.
4. Click *Connection Manager*.





Look at the Four-Character Display

The four-character display on the front of the 1756-CNB/D/E or 1756-CNBR/D/E module, shows the following information:

For this information about a CNB module	Display	Where
Address of the module	A#*xx*	*xx* is the node address of the module.
Percent of CPU usage	%C*xx*	*xx* is the percent of CPU usage. The range for the display is 00 - 99%.
Number of open connections	nCxx	*xx* is the number of open connections that the module is using.
Number of unconnected client buffers	Uc*xx*	*xx* is the number of unconnected client buffers that the module is using. You see this number only if the module is using 80% of its buffers or more. The module stops showing the number if the number drops below 50%.
Number of unconnected server buffers	Us*xx*	*xx* is the number of unconnected server buffers that the module is using. You see this number only if the module is using 80% of its buffers or more. The module stops showing the number if the number drops below 50%.
State of the module's keeper function	Kp*xx*	*xx* is the state of the module's keeper function:

If *xx* is	Then the module is
Ai	Active network keeper with either: • invalid keeper information or • keeper signature that does not match the keeper signature of the network.
Av	Active network keeper with: • valid keeper information. • keeper signature that defines the keeper signature of the network.
Ii	Inactive network keeper with either: • invalid keeper information or • keeper signature that does not match the keeper signature of the network.
Iv	Inactive network keeper with valid keeper information that matches the keeper signature of the network.
Oi	• Powering up with invalid keeper information or • offline with invalid keeper information.
Ov	• Powering up with valid keeper information that may or may not match the keeper signature of the network or • offline with valid keeper information that may or may not match the keeper signature of the network.

Number of times that the bandwidth of the module was exceeded	Bx*nn*	*nn* is the number of times that the bandwidth of the module was exceeded (bandwidth exceeded error) since the module was turned off or reset. You see this number only if the number is more than zero.

Send a Message to the CNB Module

To use a Message (MSG) instruction to learn the CPU usage of a CNB module, configure the MSG instruction as follows:

<table>
<tr><th>On this tab</th><th>For this</th><th>Type or select</th></tr>
<tr><td rowspan="8">Configuration</td><td>Message Type</td><td>CIP Generic</td></tr>
<tr><td>Service Type</td><td>Custom</td></tr>
<tr><td>Service Code</td><td>4f</td></tr>
<tr><td>Class</td><td>a1</td></tr>
<tr><td>Instance</td><td>8</td></tr>
<tr><td>Attribute</td><td>0</td></tr>
<tr><td>Source Element</td><td>Tag that uses a user-defined data type:
<table><tr><th colspan="2">Members of the data type</th><th rowspan="2">Tag value</th></tr><tr><th>Name</th><th>Data type</th></tr><tr><td>offset</td><td>DINT</td><td>0</td></tr><tr><td>size_returned</td><td>INT</td><td>2</td></tr></table></td></tr>
<tr><td>Source Length</td><td>6</td></tr>
<tr><td>Destination</td><td>INT tag in which to store the CPU usage of the CNB module (0 - 99%.)</td></tr>
<tr><td>Communication</td><td>Path</td><td>1, slot_number

where:

slot_number is the slot number of the CNB module.</td></tr>
</table>

Change CNB modules from Series D to Series E

Complete the following procedure to replace 1756-CNB/D or 1756-CNBR/D module(s) with series E modules.

IMPORTANT

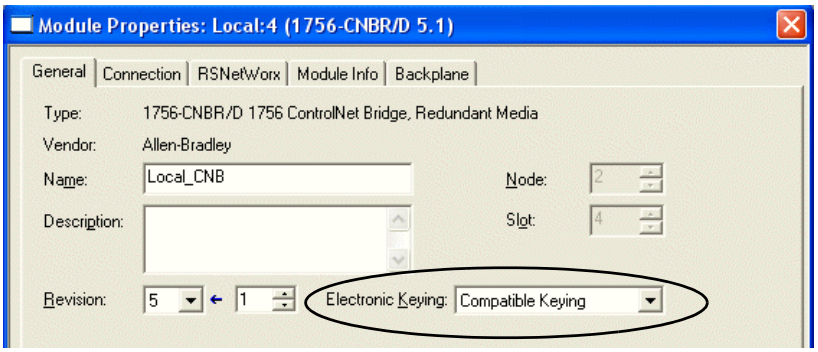
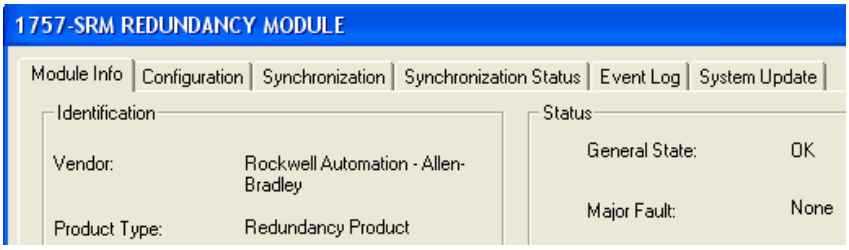
- Use this procedure only if your redundancy system is already at revision 15.
- Replace CNB modules with CNB modules and CNBR modules with CNBR modules. Otherwise your chassis won't synchronize.
- Finish this procedure once you start it.
- Each module must be the same series as its partner in the other redundant chassis. If you replace a module with a different series, you must replace the partner module with the same series.

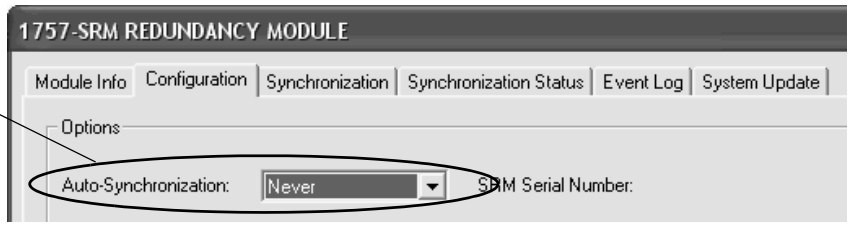
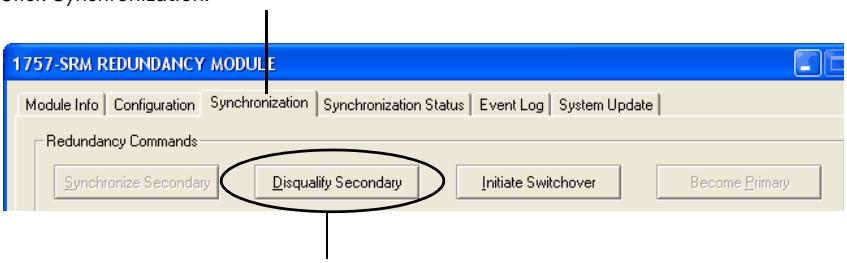
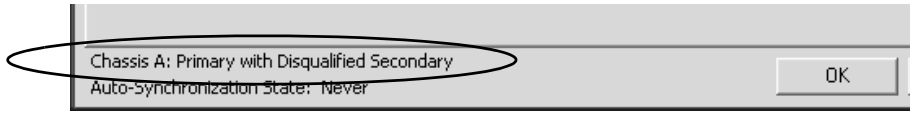
Before You Begin

This procedure is easier to complete if you first update the firmware of your 1756-CNB/D or 1756-CNBR/D module(s).

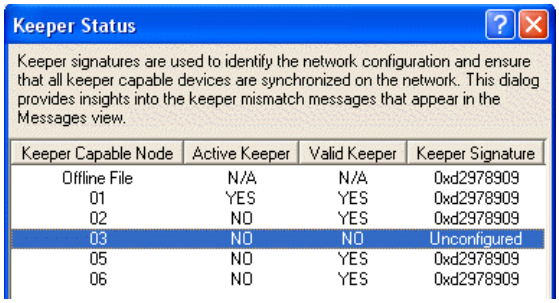
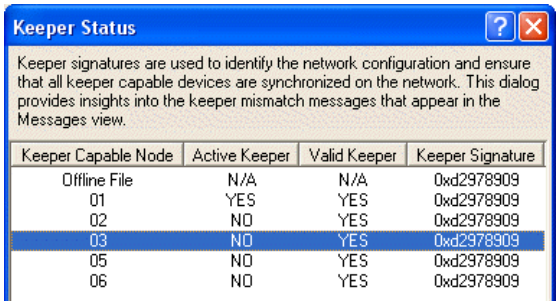
If the CNB modules are	And you	Then
Revision 11.1 or later	→	Go to Actions and start the procedure. You don't need to update the firmware of the modules.
Not revision 11.1 or later	Have a nonredundant chassis with an open slot	1. Add the revision 11 EDS files for the CNB modules, if you haven't already done so. 2. Put one of the CNB modules into the open slot of the nonredundant chassis. 3. Use ControlFlash software and update the firmware of the CNB module. 4. Remove the CNB module. 5. Repeat steps 1 thru 4 for the rest of the CNB modules. 6. Go to Actions and start the procedure.
	Don't have a nonredundant chassis with an open slot	Go to Actions and start the procedure. You'll have to use the secondary chassis to update the modules.

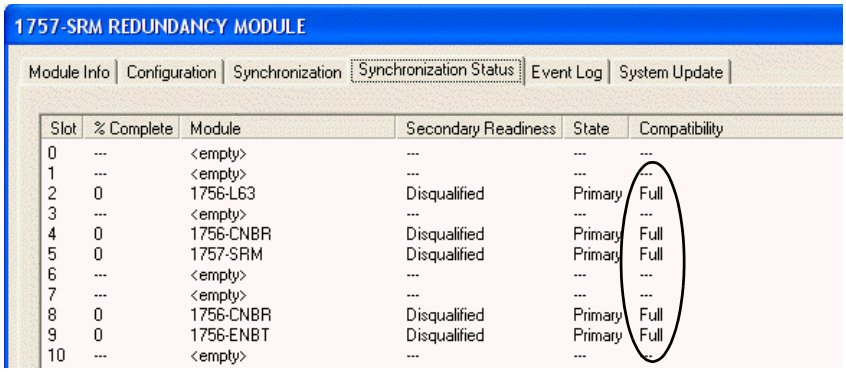
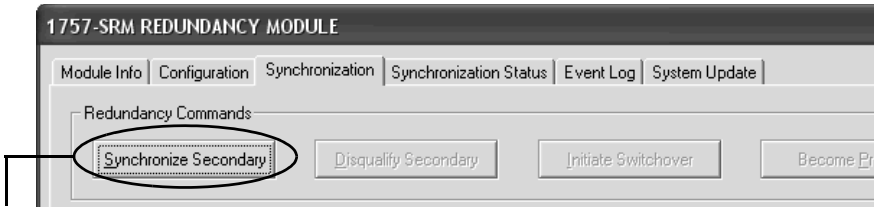
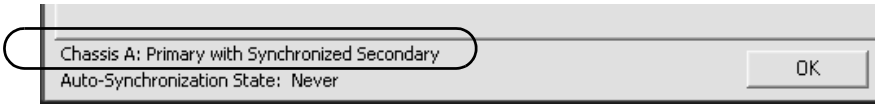
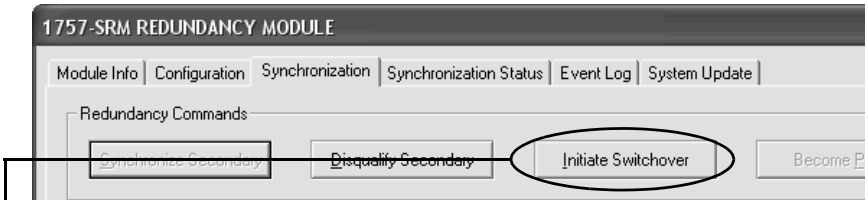
Actions

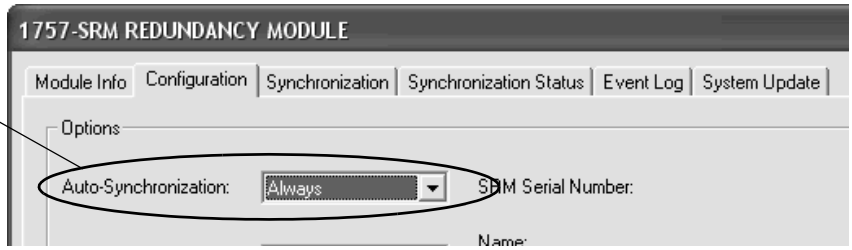
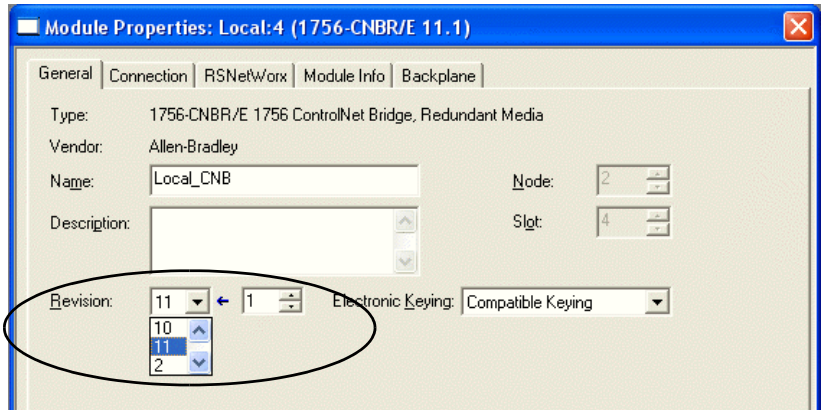
Action	Details
1. Add the latest EDS files.	Add the revision 11 EDS files for the 1756-CNB and 1756-CNBR modules, if you haven't already done so,
2. Prepare the RSLogix 5000 project.	A. Start the RSLogix 5000 software and go online with the primary controller. B. For each CNB/D/E or CNBR/D/E module in the local chassis, set the electronic keying to compatible keying or disable keying and apply the changes.  C. Save the project.
3. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Action	Details
4. Disqualify the secondary chassis,	A. Click *Configuration*. B. Set *Auto-Synchronization* to *Never*.  C. Choose *Apply* and then *Yes*. D. Click *Synchronization*.  E. Choose *Disqualify Secondary* and then *Yes*. The secondary chassis is disqualified.  F. Choose *OK*.
5. Did you already update the firmware of the series E modules?	Did you already update the firmware of the series E modules? • Yes — Go to step 7. • No — Continue with step 6.

Action	Details
6. Update the firmware of the series E modules.	A. Remove the 1757-SRM module from the secondary chassis. B. Set the address of each series E module to the address of its corresponding series D module plus one. C. Replace each series D module with the corresponding series E module. **Important:** Make sure you connect the correct ControlNet tap to each module. D. Use ControlFlash software and update the firmware of each series E module. E. Remove the series E modules from the secondary chassis and set their addresses to match the original series D modules. F. Repeat steps B thru E for the second set of series E modules. G. Put the secondary SRM back into the secondary chassis. H. Put one set of series E modules into the secondary chassis. **Important:** Make sure that you use the correct address, slot, and ControlNet tap for each module. I. Go to step 8.
7. Replace the CNB modules in the secondary chassis.	Replace the CNB modules in the secondary chassis with series E modules. As you replace the modules: • make sure that you set each module to the same address as the module that it's replacing. • make sure that you connect the correct ControlNet tap. To avoid connecting the wrong tap, replace the modules one at a time and reconnect the ControlNet tap.

Action	Details
8. Update the keeper signatures of the CNB modules.	A. Start RSNetWorx for ControlNet and open the network configuration file. B. Go online with the network. You don't have to browse the entire network. C. Select Network > Keeper Status. D. Select the node number of the secondary CNB and click Update Keeper.  E. Verify that the keeper signature has been updated.  F. Repeat steps D and E for the other CNB modules in the secondary chassis. G. Click Close.

Action	Details
9. Reset the secondary CNB modules.	A. Cycle power to the secondary chassis. B. On the *Synchronization Status* tab of the configuration tool, verify that the modules show full compatibility. 
10. Synchronize the secondary chassis.	A. Click *Synchronization*.  B. Choose *Synchronize Secondary* and then *Yes*. C. Wait for the chassis to synchronize.
The chassis are synchronized.	
11. Initiate a switchover.	 Choose *Initiate Switchover* and *Yes*.
12. Replace the CNB modules in the new secondary chassis.	Repeat steps 7 thru 9 for the CNB modules in the new secondary chassis.

Action	Details
13. Synchronize the chassis.	A. Go to the SRM configuration tool for the primary chassis. B. On the *Configuration* tab, change the *Auto-Synchronization* option to Always.  C. Choose *Apply* and *Yes*.
14. In the RSLogix 5000 project, change the revision of the new local CNB modules to revision 11.	

Store or Load a Project Using Nonvolatile Memory

Nonvolatile memory lets you keep a copy of your project on the controller.

Term	Description
Nonvolatile memory	Memory of the controller that retains its contents while the controller is without power or a battery.
Store	To copy a project to the nonvolatile memory of the controller. This overwrites any project that is currently in the nonvolatile memory.
Load	To copy a project from nonvolatile memory to the user memory (RAM) of the controller. This overwrites any project that is currently in the controller.

In a redundant system, store or load a project only while the secondary chassis is disqualified.

Action	Details
Store a Project	**Important**: If your computer is online with the controller over a ControlNet network, check the CPU usage of the CNB module. The CPU usage module must be less than about 75% for the store to work. 1. Put the primary controller in program mode (program or remote program). 2. Open the Module Configuration properties for one of the 1757-SRM modules. 3. Set the *Auto-Synchronization* option to *Conditional*. 4. Disqualify the secondary chassis. 5. Store the project that is in the primary controller. For step-by-step procedures on how to store a project, see *Logix5000 Controllers Common Procedures*, publication 1756-PM001. **Important**: Do not go back online to the primary controller until you complete the rest of the steps in this procedure. 6. Go online to the secondary controller and store the project. 7. Return to the Module Configuration properties for one of the 1757-SRM modules. 8. Synchronize the controllers. 9. Set the *Auto-Synchronization* option to the desired option.
Load a Project—User Initiated	1. Disqualify the secondary chassis. 2. Go online to the primary controller. 3. In the primary controller, load the project. For step-by-step procedures on how to store a project, see *Logix5000 Controllers Common Procedures*, publication 1756-PM001. 4. Synchronize the controllers.
Load a Project—On Power Up	This Load Image option works the same as in a nonredundant system. • The controller loads the project on power up. • The controller loads the project before it activates the redundancy feature.
Load a Project—On Corrupt Memory	This Load Image option works the same as in a nonredundant system. • The controller loads the project when the memory is empty or corrupt. • The controller loads the project before it activates the redundancy feature.

Store a Project to Nonvolatile Memory While a Process Is Running

Complete the following procedure to store an updated project and firmware to the nonvolatile memory of the controller. This procedure lets you store a project while the process is running.

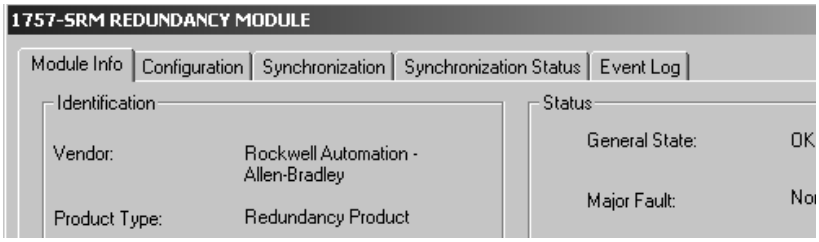
IMPORTANT Use this procedure only with a 1756-L6x controller. Do not use the nonvolatile memory of a 1756-L55M2x controller if you've updated it to revision 15. Otherwise the controller will have an unrecoverable fault (solid red OK light) and clear the project from its memory.

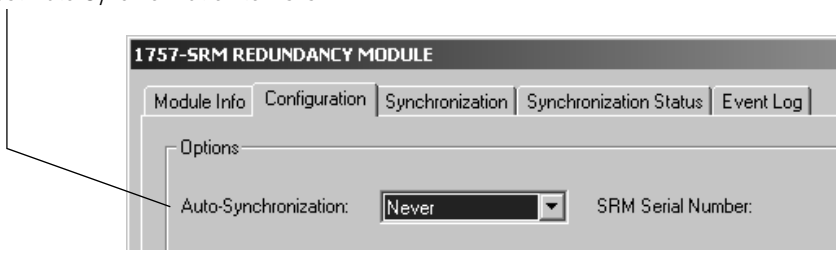
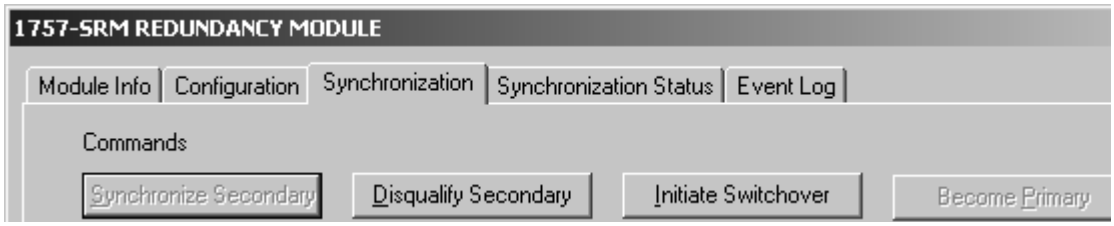
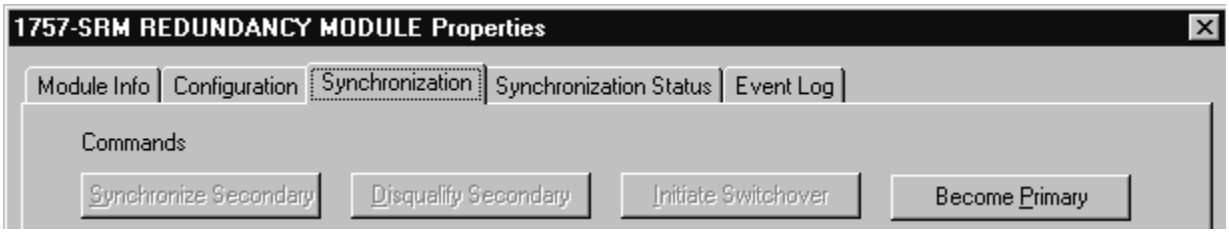
Action	Details
1. Make sure the chassis are synchronized.	Synchronize the chassis if they aren't already synchronized.
2. Disqualify the secondary chassis.	A. Open the SRM configuration tool for the primary chassis. B. Set the Auto-Synchronization option to Never. C. Disqualify the secondary chassis.
3. Store the secondary controller's project.	A. Go online to the secondary controller B. Store the project to the nonvolatile memory of the secondary controller. For step-by-step procedures on how to store a project, see Logix5000 Controllers Common Procedures, publication 1756-PM001. **Important**: Do not go back online to the secondary controller until you complete the rest of the steps in this procedure.
4. Initiate a switchover.	A. Go to the SRM configuration tool. B. Synchronize the chassis. C. Initiate a switchover.
5. Store the new secondary controller's project.	A. Go online to the new secondary controller B. Store the project to the nonvolatile memory of the secondary controller. For step-by-step procedures on how to store a project, see Logix5000 Controllers Common Procedures, publication 1756-PM001. **Important**: Do not go back online to the secondary controller until you complete this procedure.
6. Synchronize the chassis.	A. Go to the SRM configuration tool. B. Set the Auto-Synchronization option to the desired option. C. Synchronize the chassis.

Update a Module

Complete the following procedure to upgrade the revision of your redundant modules. This procedure minimizes the time your process is down during an upgrade.

IMPORTANT Don't connect your computer to the network access port on a CNB module in the primary chassis. You'll lose access to the network when you turn off power to the chassis.

Action	Details
1. Upload and save the project.	A. Do you have an up-to-date copy of the project for the controller stored offline? • Yes — Go to step 2. • No — Continue with step B. B. Upload the project in the primary controller. C. Save the project.
2. Open the SRM configuration tool for the secondary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Action	Details
3. Disqualify the secondary chassis,	A. Click *Configuration*. B. Set Auto-Synchronization to Never.  C. Choose *Apply* and then *Yes* to confirm. D. Click *Synchronization*.  E. Choose *Disqualify Secondary* and then *Yes* to confirm.
4. Upgrade the required firmware of the secondary chassis.	See the *ControlLogix Controller and Memory Board Installation Instructions*, publication 1756-IN101.
5. Make the secondary controller the new primary controller.	A. Start RSLogix 5000 software. B. Download the project to the secondary controller. C. When it is safe to stop the system, change the primary controller to Program Mode. D. Turn off power to the primary chassis. E. Go to the 1757-SRM properties of the secondary chassis.  F. Choose *Become Primary*.

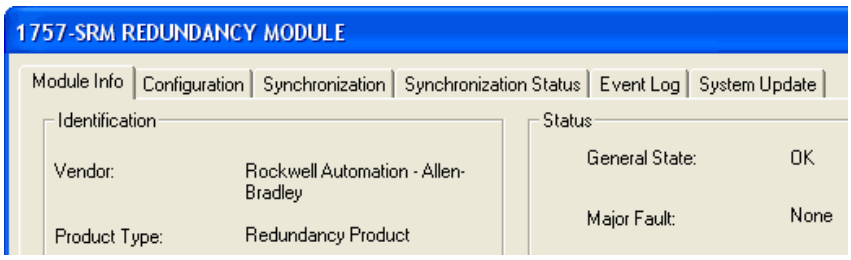
Action	Details
6. Clear the fault of the new primary controller.	A. In RSLogix 5000 software, go online to the new primary controller. B. The controller is faulted. When a disqualified secondary controller becomes a primary controller, the controller experiences a major fault. C. From the *Communications* menu, choose *Clear Faults*. D. To start control of the process, from the *Communications* menu, choose *Run Mode*.
7. Upgrade the other redundant chassis.	A. Turn on power to the other redundant chassis. B. Upgrade the required firmware of the chassis.
8. Change the Auto-Synchronization Option to *ALWAYS*.	A. Open the SRM configuration tool for the primary chassis. B. On the *Configuration* tab, change the *Auto-Synchronization* option to *Always*. C. Choose *OK*.

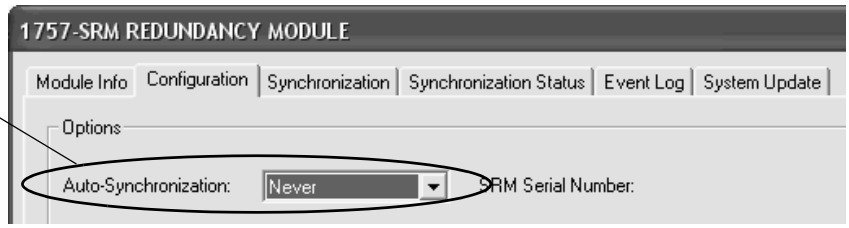
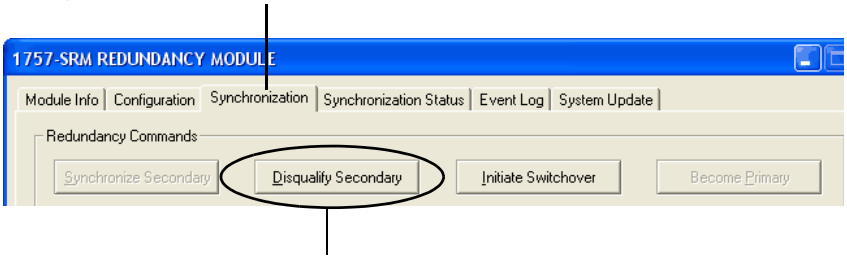
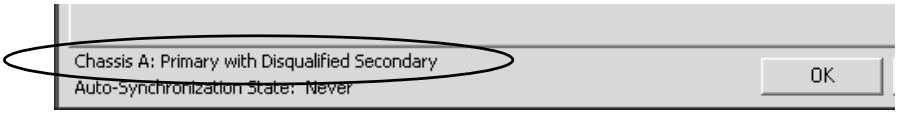
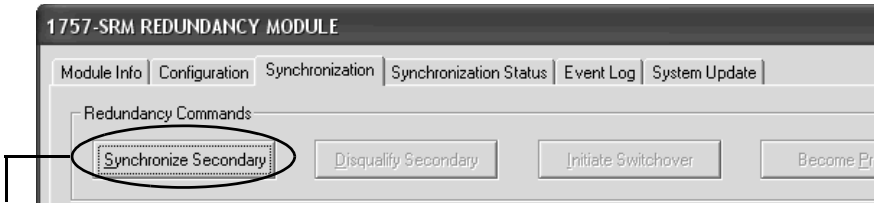
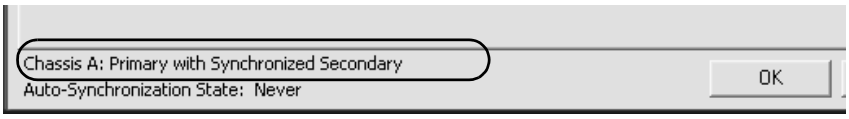
Update a System That Is Already at Revision 13

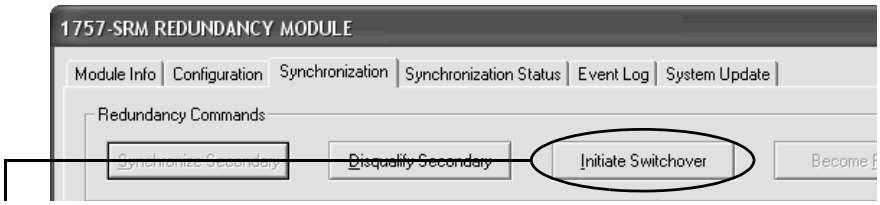
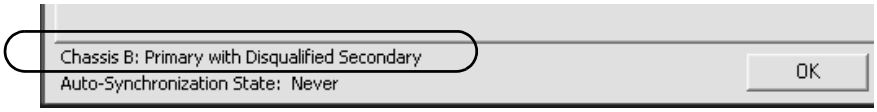
Complete the following procedure to update the firmware of a redundant chassis without shutting down the process:

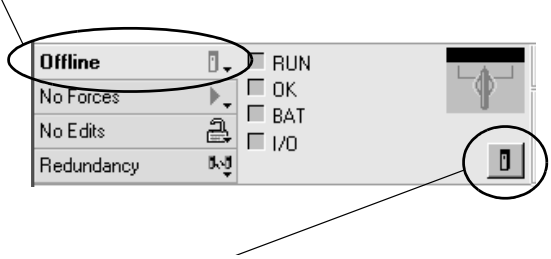
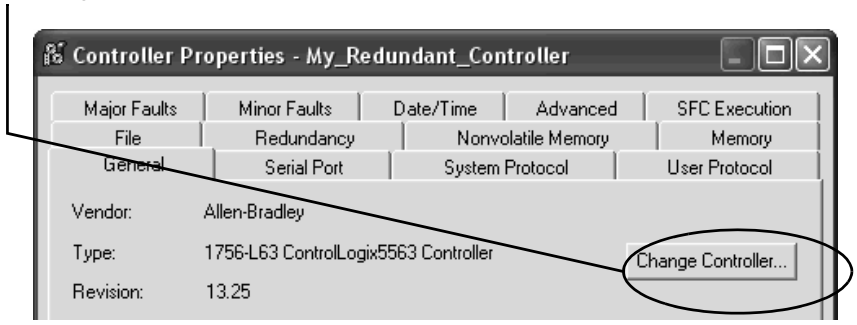
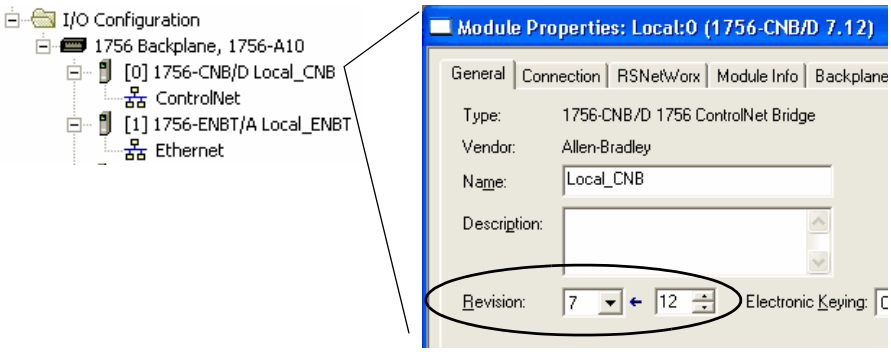
IMPORTANT

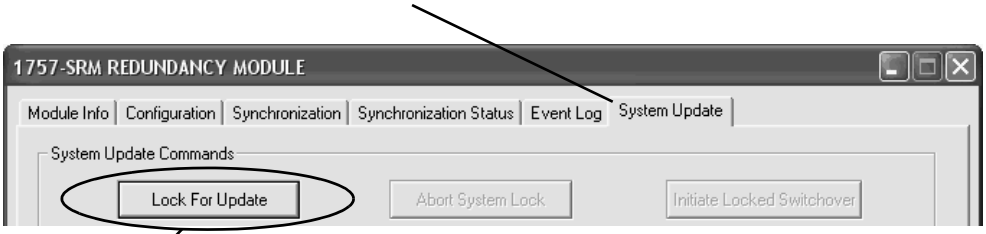
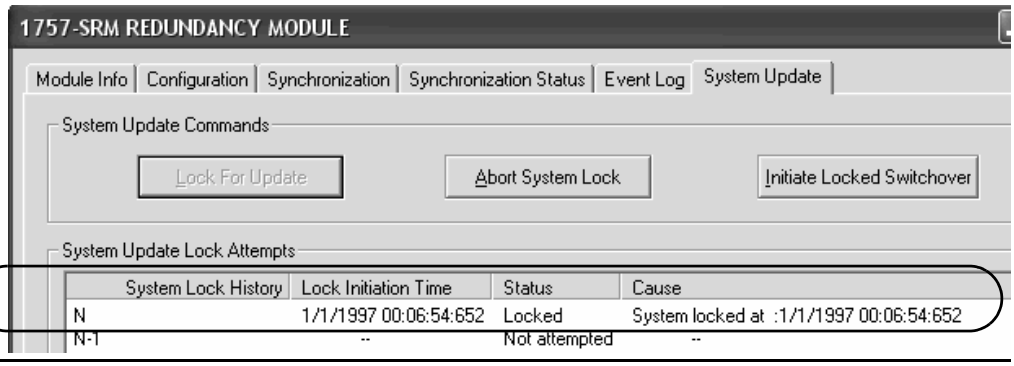
- Use this procedure only if your system is already at revision 13.
- Do not use this procedure if:
  - your system is at revision 11 or earlier.
  - your system isn't operating yet.
- During this procedure, you won't be able to use RSLogix 5000 software to change the mode of the controller. Use the keyswitch on the front of the controller to change its mode.
- Leave RSNetWorx for ControlNet software closed or offline throughout this procedure. Otherwise, you'll see errors in the RSNetWorx software during the update process.
- During this procedure:
  - Do not make any changes to the RSLogix 5000 project other than the ones called out in this procedure.
  - Make sure no one else makes changes to the project.

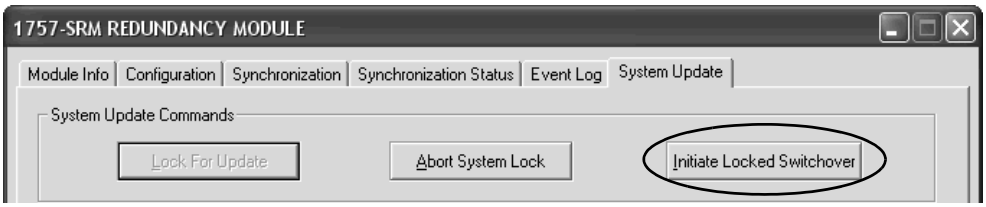
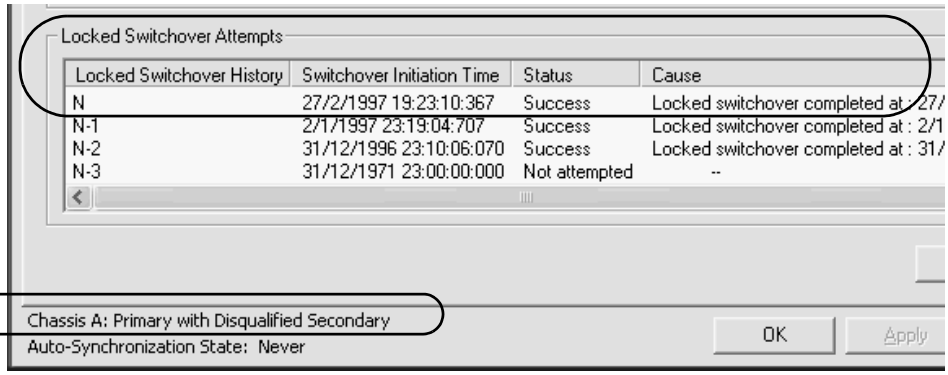
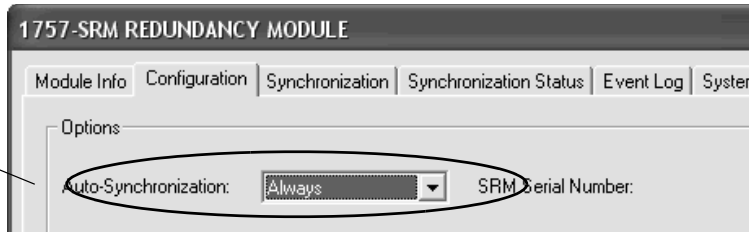
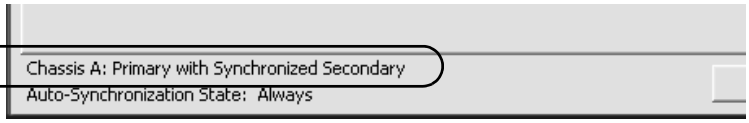
Action	Details
1. Update the software	A. Go to the tool tray of your computer and shutdown RSLinx software. B. Update the following software: 1. 1757-SRM System Redundancy Module Configuration tool 2. RSLogix 5000 software 3. RSLinx software 4. RSNetWorx software 5. ControlFLASH firmware update kit. If you're planning to uninstall version 13 of your RSLogix 5000 software, wait until you've completed and validated your update.
2. Add the latest EDS files.	Start ⇒Programs ⇒Rockwell Software ⇒RSLinx Tools ⇒EDS Hardware Installation Tool
3. Put the keyswitches in the REM position.	Put the keyswitch of each redundant controller to the REM position. Otherwise you won't be able to update the system.
4. Open the SRM configuration tool for the primary chassis.	A. Start RSLinx software. B. From the *Communications* menu, choose *RSWho*. C. Open the branches of your network until you find the 1757-SRM module in the primary chassis. D. Right-click the SRM and choose *Module Configuration*. 

Action	Details
5. Disqualify the secondary chassis,	A. Click *Configuration*. B. Set *Auto-Synchronization* to *Never*.  C. Choose *Apply* and then *Yes*. D. Click *Synchronization*.  E. Choose *Disqualify Secondary* and then *Yes*.
The secondary chassis is disqualified.	 F. Choose *OK*.
6. Update the SRM module in the secondary chassis.	A. Start the ControlFLASH firmware update tool. B. Update the 1757-SRM module in the secondary chassis.
7. Synchronize the chassis.	A. Go to the SRM configuration tool.  B. Choose *Synchronize Secondary* and then *Yes*.
The chassis are synchronized.	

Action	Details
8. Initiate a switchover.	 A. Choose *Initiate Switchover* and *Yes*. B. Wait for the system to switchover.
The other chassis is now the primary chassis.	
9. Update the modules in the new secondary chassis.	Use the ControlFLASH firmware update tool to update the modules in the new secondary chassis.
10. Prepare the RSLogix 5000 project for the update.	A. Start RSLogix 5000 software and go online to the primary controller. B. Set the watchdog time for each task to this value or more: Minimum watchdog time = (2 * `maximum_scan_time`) + 150 ms where: `Maximum_scan_time` is the maximum scan time for the entire task when the secondary controller is synchronized. C. Cancel or assemble any test edits. D. Remove all SFC forces from the project. E. Make sure that you don't need to make any changes to: • I/O Forces — Once you start this procedure, you won't be able to disable or enable I/O forces until you update both chassis. • I/O configuration You can make those changes again when the update is done and both chassis synchronize. F. Save the project.

Action	Details
11. Change the project revisions.	A. Go offline.  B. Click the Controller Properties button. C. Change the controller to the newer revision.  **Example**: Change the controller from revision 13 to revision 15. D. Change the Revision of each local communication module to match what its revision will be after you update its firmware. **Example:** Suppose you plan to update the firmware of each CNB/D module in the redundant chassis to revision 7.12. In that case, open the properties for each CNB/D module in the chassis and set the revision to 7.12.  If you can't select the new revision, then change the electronic keying to either compatible keying or disable keying.

Action	Details
12. Download the project to the secondary controller.	**Important**: If I/O forces are enabled in the offline project, the software asks if you want to enable the forces in the controller. Even if you choose *No*, I/O forces stay enabled in the primary controller and become enabled in this controller after you switchover. A. Use RSLogix 5000 software to download the project to the controller in the secondary chassis. The secondary chassis has the higher network address of the redundant pair. B. Go offline. **Important:** Stay offline until you finish this procedure.
13. Lock the system for update.	**Important:** Do not abort a system lock. Otherwise, you'll clear the project from the secondary controller. A. Open the SRM configuration tool for the primary chassis. B. Click *System Update*.  C. Choose *Lock For Update* and *Yes*. D. Wait for the system to lock. It takes longer than a normal synchronization.
The system is locked.	

Action	Details
14. Initiate a Locked Switchover.	 A. Choose *Initiate Locked Switchover* and *Yes*. B. Wait for the system to switchover. A locked switchover takes about as long as a normal switchover.
The other chassis is now the primary chassis.	
15. Update the other redundant chassis.	Use the ControlFLASH firmware update tool to update the rest of the modules in the new secondary chassis. You've already updated the SRM module in this chassis.
16. Synchronize the chassis.	A. Go to the SRM configuration tool for the primary chassis. B. On the *Configuration* tab, change the *Auto-Synchronization* Option to *ALWAYS*.  C. Choose *Apply* and *Yes*.
The chassis synchronize.	 D. Change the Date and Time in the SRM module. E. Choose *OK*.

Set Up EtherNet/IP Communication Across Subnets

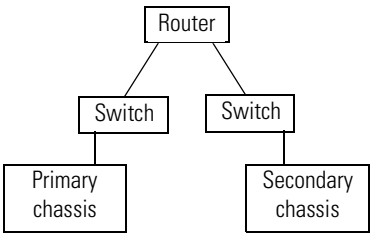
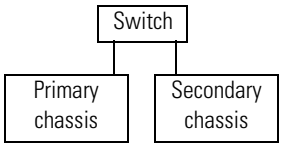
Purpose of This Chapter

To keep HMIs and messages pointing to the primary chassis when IP swapping is not in use

When to Use This Chapter

Use this chapter when:

- you want to use alias topics instead of IP swapping.
- your primary and secondary chassis are on different EtherNet/IP subnets.

If both redundant chassis are on	Then
Different subnets 	You must point your HMIs and messages to the new primary chassis after a switchover. Use this appendix to show you how.
Same subnet 	Stop. Use IP swapping instead. This lets you use the same IP address regardless of which chassis is primary. See Chapter 2.

When primary and secondary chassis are on different EtherNet/IP subnets, they keep their IP addresses during a switchover. This means that your and other controllers must be able to switch between the IP address of each redundant chassis.

How to Use This Chapter

This chapter provides the following information:

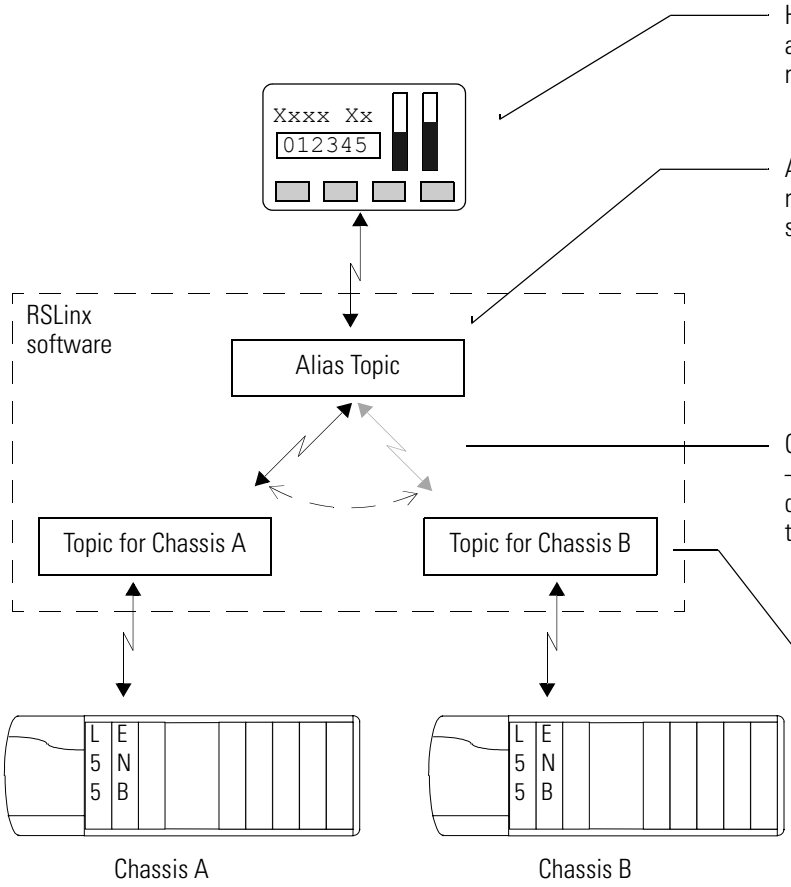
Topic	Page
Keep an HMI Communicating with the Primary Chassis	150
Keep a Message Going to the Primary Chassis	156

Keep an HMI Communicating with the Primary Chassis

If you're not using IP swapping, your HMIs must direct their communication to the new primary chassis after a switchover. ControlLogix Redundancy Alias Topic Switcher software can most easily do this. Look for this software on the CD along with your firmware.

IMPORTANT To use the ControlLogix Redundancy Alias Topic Switcher software, your computer needs an activation file for RSLinx software. The activation file lets you perform DDE/OPC communication.

The ControlLogix Redundancy Alias Topic Switcher software works with RSLinx alias topics. Together they keep your HMI communicating with the primary controller after a switchover.



HMI tags – In your HMI project, each tag references an alias topic in RSLinx software. This lets RSLinx software redirect communications to the appropriate chassis.

Alias topic – In RSLinx software, an alias topic represents a flexible communication path to one of several controllers (topics).

- In a ControlLogix redundancy system, the alias topic points to the topic for the primary controller.
- When a switchover occurs, the alias topic points to the topic for the new primary controller.

ControlLogix Redundancy Alias Topic Switcher software – Automatically reads a value in RSLinx software to determine which controller is primary. It then commands the alias topic to switch to the topic for that controller.

Topic – In RSLinx software, a topic represents a specific path to a controller. Since each ENBT and EWEB module uses a unique IP address, create a topic for the controller in each redundant chassis.

To keep an HMI communicating with the primary chassis:

- install the ControlLogix Redundancy Alias Topic Switcher Software.
- configure a Driver to Communicate with the Primary and Secondary EtherNet/IP Modules.
- create a DDE/OPC topic for each controller.
- create an alias topic.
- set up the alias topic switcher.
- address the alias topic in the HMI project.

Install the ControlLogix Redundancy Alias Topic Switcher Software

The ControlLogix Redundancy Alias Topic Switcher software maintains communication between your HMI project and the primary controller after a switchover.

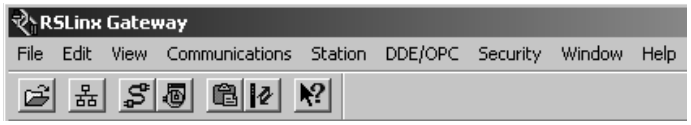
To install the Alias Topic Switcher software, use the *ControlLogix Redundancy Alias Topic Switcher.Exe* file. The file is located on the same CD as the firmware for your redundancy system.

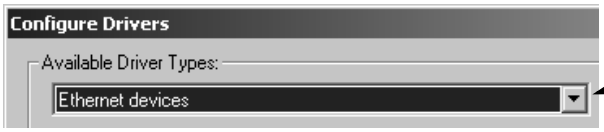
The Alias Topic Switcher software runs as a service. It starts automatically when you start your computer and shows up in the tool tray of your desktop.

ControlLogix Redundancy Alias Topic Switcher

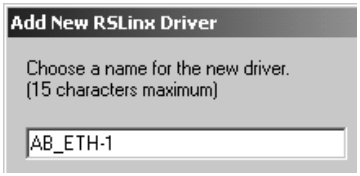
Configure a Driver to Communicate with the Primary and Secondary EtherNet/IP Modules

1. Start RSLinx software.





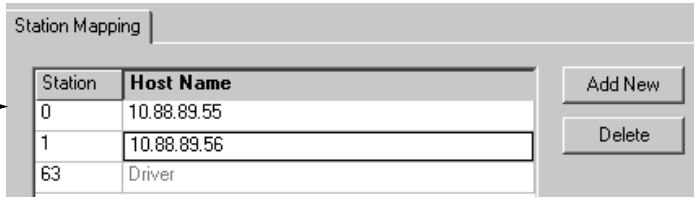
2. Click .



3. Select *Ethernet devices* and choose Add New...

4. Accept the default name.

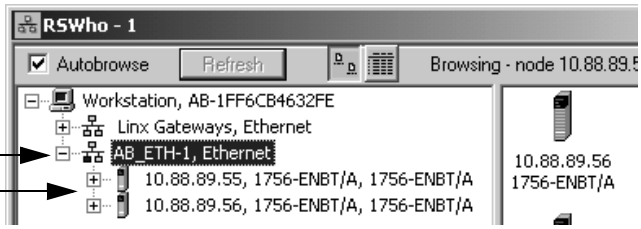
5. Type the IP address of each ENBT or EWEB module.



To add another IP address, choose Add New

6. Choose OK and then Close

7. Click .

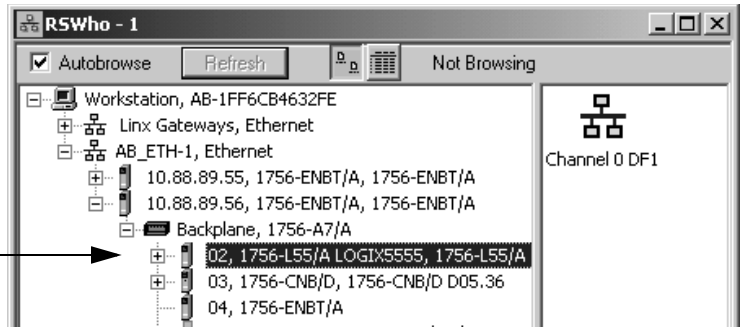


Driver that you just added

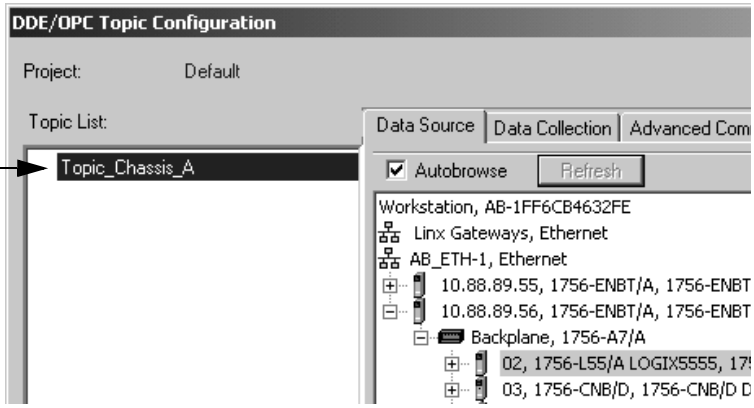
Modules in the redundant chassis

Create a DDE/OPC Topic for Each Controller

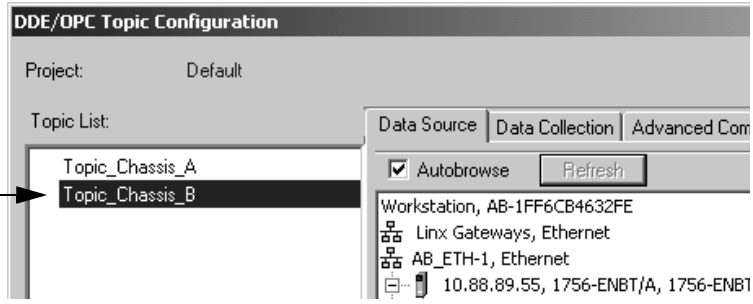
1. Browse to the controller in Chassis A.
2. Right-click the controller and choose *Configure New DDE/OPC Topic.*



3. Rename the topic to indicate that this is Chassis A.
4. Choose Done and then Yes (Yes—update topic.)

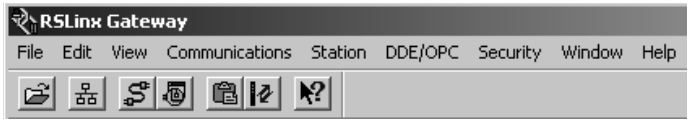


5. Create a topic for the controller in Chassis B.



Create an Alias Topic

1. In RSLinx software, choose *DDE/OPC* ⇒ *Alias Topic Configuration*.



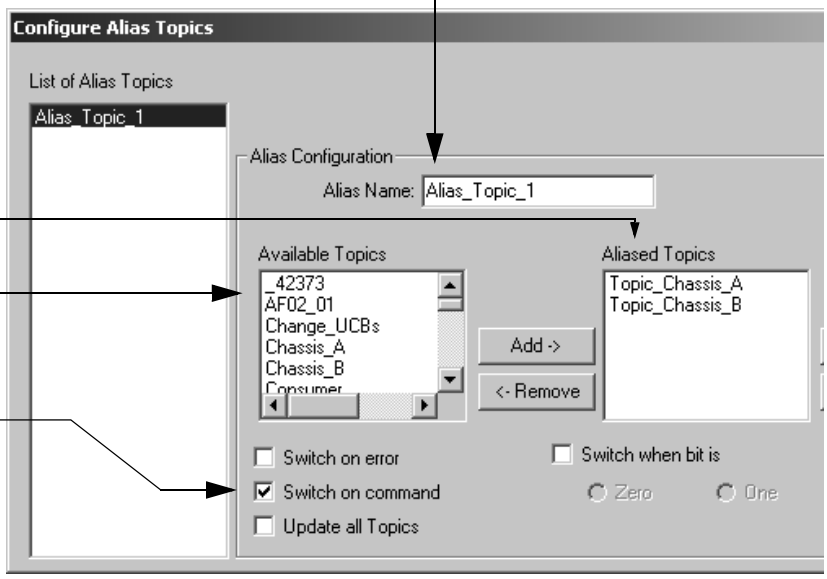
2. Type a name for the alias topic that will communicate with this pair of redundant controllers

3. Add the topic for each redundant controller to the *Aliased Topics* list.

   To add a topic, select the topic and choose Add ->

4. Select (check) the *Switch on command* check box. Clear (uncheck) the remaining check boxes.

   This lets the ControlLogix Redundancy Alias Topic Switcher software control which topic the alias topic uses for communication.



5. Choose Save and then Close

Set Up the Alias Topic Switcher

IMPORTANT If you start the Alias Topic Switcher software without access to an RSLinx activation file (for example, without a version of RSLinx which supports OPC), the following error occurs:

0x80040112

(The text for the message depends on your operating system.)

1. In the system tray, right-click the Redundancy Switch icon and choose *Open Alias Topic Switching Tool*.

2. In the *Redundancy Alias Topic Switching Tool* window, choose

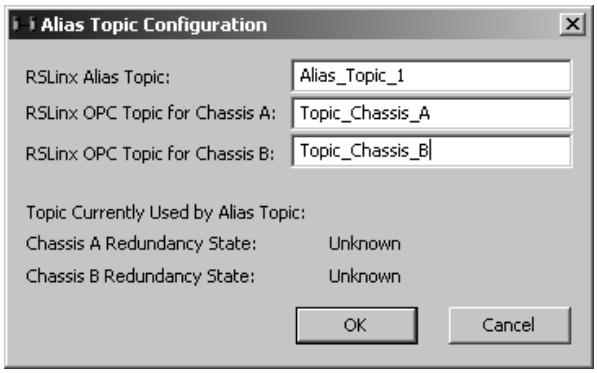
   Add New

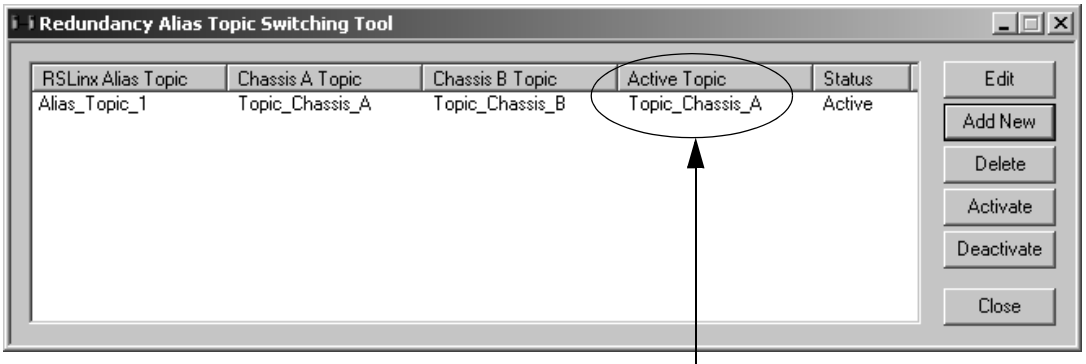
3. Type the topic names:

   a. Alias topic

   b. Topic for the controller in Chassis A

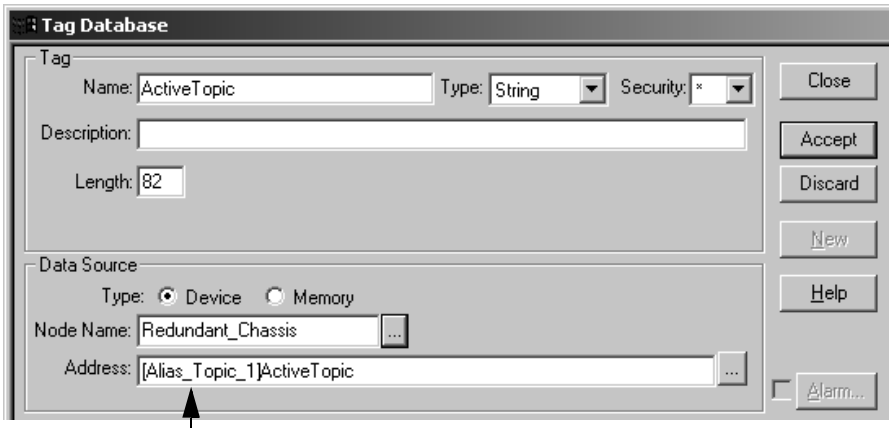
   OK





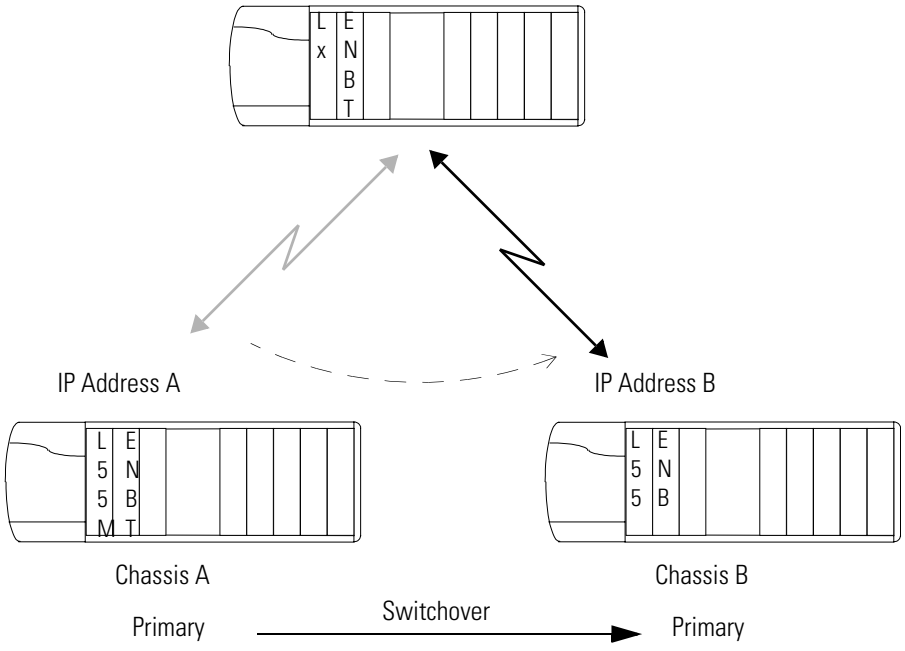
Topic that the alias topic is currently using

Address the Alias Topic in the HMI Project

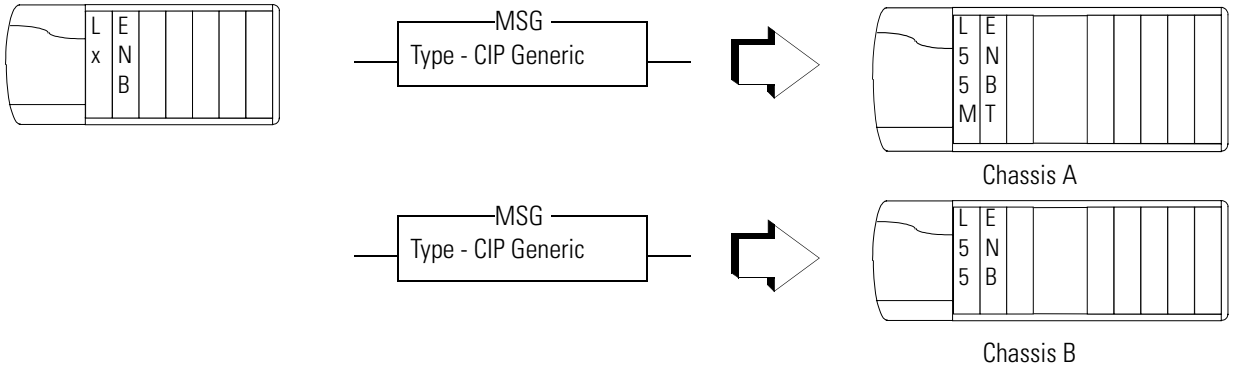


Keep a Message Going to the Primary Chassis

If you're not using IP swapping, any controller that sends a message to a redundant chassis has to point to the new primary chassis after a switchover.



In this procedure, use CIP Generic messages to determine which chassis is primary. Then send a Message (MSG) instruction to the primary controller.

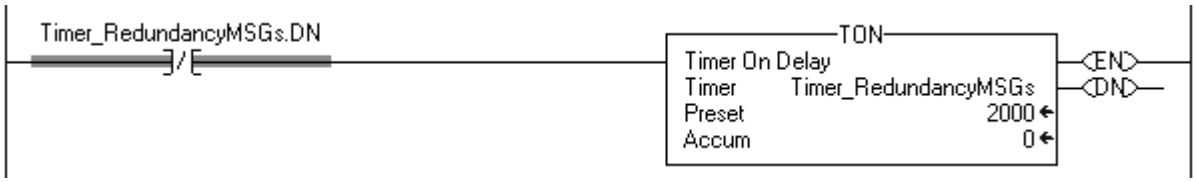


To keep a Message (MSG) instruction going to the new primary chassis after a switchover:

- create a periodic trigger for the messages.
- obtain the redundancy state of chassis A.
- obtain the redundancy state of chassis B.
- determine which chassis is primary.
- send the message to the appropriate controller.

Create a Periodic Trigger for the Messages

Free-running timer that triggers the execution of MSG instructions. The timer runs for 2 seconds (2000 ms) and then resets and starts timing again. Every 2 seconds, *Timer_RedundancyMSGs.DN* = 1 for a single scan. The MSG instructions use this bit as one of their conditions for execution.



Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER

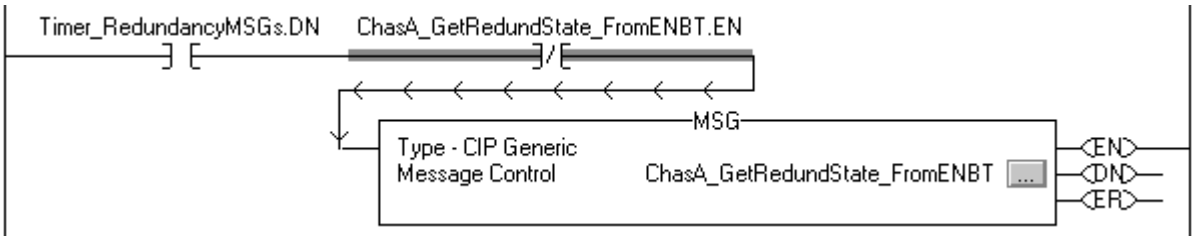
Get the Redundancy State of Chassis A

If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up so execute the MSG instruction again)

And *ChasA_GetRedundState_FromENBT.EN* = 0 (The MSG instruction is not currently enabled.)

Then

Execute a MSG instruction that gets the redundancy state of Chassis A from the ENBT module in Chassis A. Store the value in *ChasA_RedundancyState* (data type = DINT).



Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER
ChasA_GetRedundState_FromENBT	Message instruction that gets the redundancy state of Chassis A		MESSAGE
ChasA_RedundancyState	Redundancy state of the Chassis A: 2 = PwQS 3 = PwDS 4 = PwNS		DINT

MSG parameter	Value
Message Type	CIP Generic
Service Type	Get Attribute Single
Service Code	e
Class	c0
Instance	1
Attribute	4
Source Element	

MSG parameter	Value
Source Length	
Destination	*ChasA_RedundancyState*
Path (Communication tab)	Specify the 1756-ENBT module in Chassis A. Use either of the following methods: • Add the module to the I/O configuration of the controller. Then use the *Browse* button on the *Communication* tab to identify the module. • Type the path using port numbers and addresses.

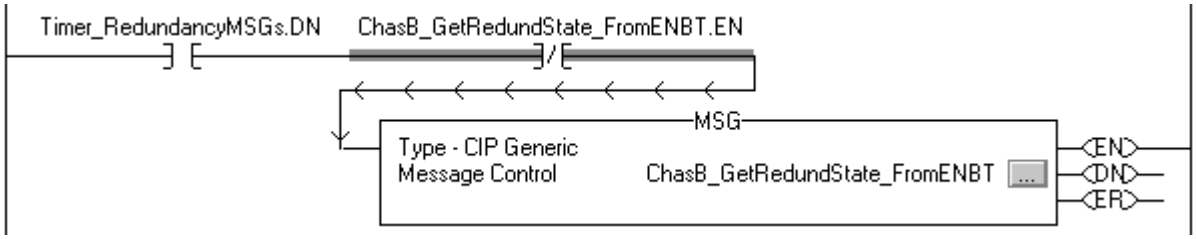
Get the Redundancy State of Chassis B

If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up so execute the MSG instruction again)

And *ChasB_GetRedundState_FromENBT.EN* = 0 (The MSG instruction is not currently enabled.)

Then

Execute a MSG instruction that gets the redundancy state of Chassis B from the ENBT module in Chassis B. Store the value in *ChasB_RedundancyState* (data type = DINT).



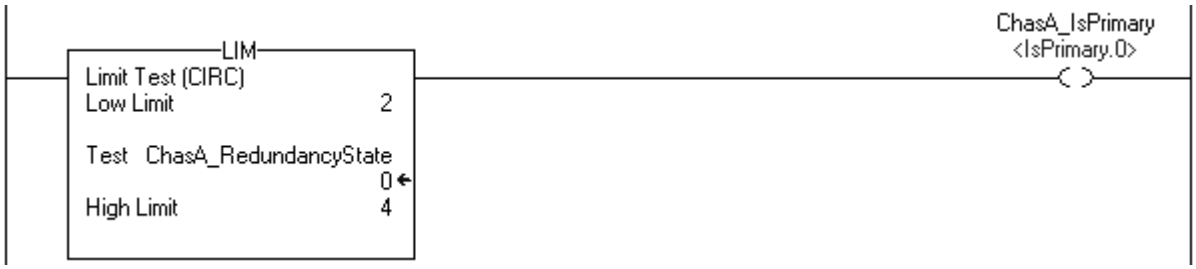
Tag Name	Description	Alias For	Data Type
Timer_RedundancyMSGs	Periodic trigger for the execution of MSG instructions. Triggers MSGs every 2s.		TIMER
ChasB_GetRedundState_FromENBT	Message instruction that gets the redundancy state of Chassis B		MESSAGE
ChasB_RedundancyState	Redundancy state of the Chassis B: 2 = PwQS 3 = PwDS 4 = PwNS		DINT

MSG parameter	Value
Message Type	CIP Generic
Service Type	Get Attribute Single
Service Code	e
Class	c0
Instance	1
Attribute	4
Source Element	
Source Length	
Destination	*ChasB_RedundancyState*
Path (Communication tab)	Specify the 1756-ENBT module in Chassis B. Use either of the following methods: • Add the module to the I/O configuration of the controller. Then use the *Browse* button on the *Communication* tab to identify the module. • Type the path using port numbers and addresses.

Determine Which Chassis is Primary

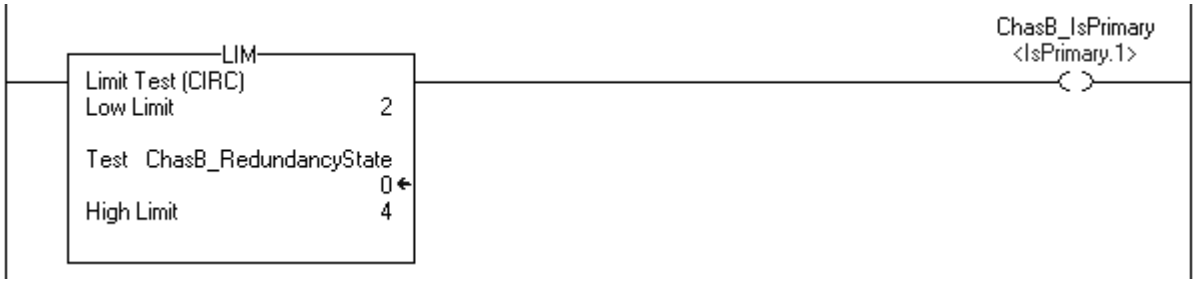
If *ChasA_RedundancyState* = 2, 3, or 4 then

ChasA_IsPrimary = 1. (Chassis A is the primary chassis.)



If *ChasB_RedundancyState* = 2, 3, or 4 then

ChasB_IsPrimary = 1. (Chassis B is the primary chassis.)



Tag Name	Description	Alias For	Data Type
ChasA_RedundancyState	Redundancy state of the Chassis A: 2 = PwQS 3 = PwDS 4 = PwNS		DINT
ChasB_RedundancyState	Redundancy state of the Chassis B 2 = PwQS 3 = PwDS 4 = PwNS		DINT

Tag Name	Description	Alias For	Data Type
ChasA_IsPrimary	If set (1), then Chassis A is the primary chassis.	IsPrimary.0	BOOL
ChasB_IsPrimary	If set (1), then Chassis B is the primary chassis.	IsPrimary.1	BOOL
IsPrimary	Each bit represents the primary status for an individual chassis within a redundant chassis pair. 1 = primary. 0 = not primary. A single DINT tag for all the chassis uses less memory than a unique tag for each chassis.		DINT

Send the Message to the Appropriate Controller

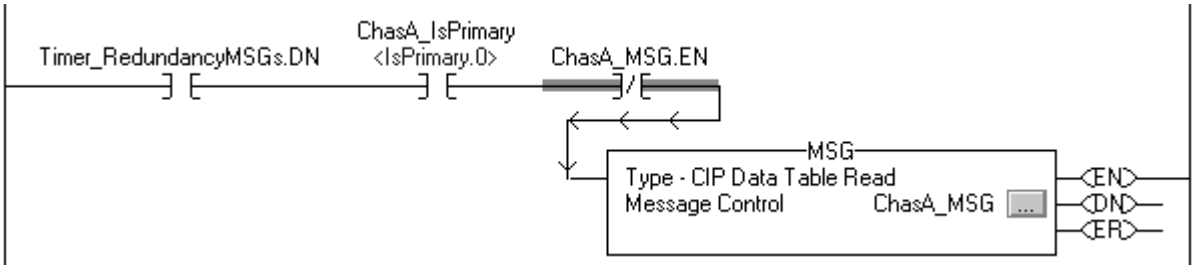
If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up.)

And *ChasA_IsPrimary* = 1. (Chassis A is the primary chassis.)

And *ChasA_MSG.EN = 0* (The message is not currently enabled.)

Then

Execute the MSG instruction for the controller in Chassis A.



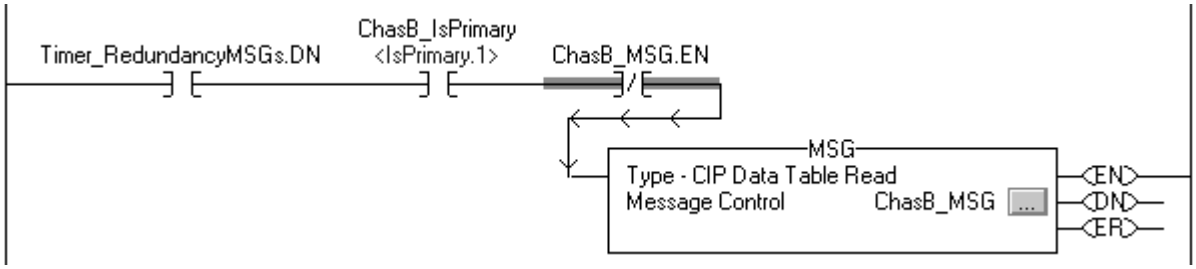
If *Timer_RedundancyMSGs.DN* = 1 (2 seconds are up.)

And *ChasB_IsPrimary* = 1. (Chassis B is the primary chassis.)

And *ChasB_MSG.EN = 0* (The message is not currently enabled.)

Then

Execute the MSG instruction for the controller in Chassis B.



Tag Name	Description	Alias For	Data Type
ChasA_IsPrimary	If set (1), then Chassis A is the primary chassis.	IsPrimary.0	BOOL
ChasA_MSG	Message instruction that transfers data between this controller and the controller in redundant Chassis A		MESSAGE
ChasB_IsPrimary	If set (1), then Chassis B is the primary chassis.	IsPrimary.1	BOOL
ChasB_MSG	Message instruction that transfers data between this controller and the controller in redundant Chassis B		MESSAGE

Notes:

Convert an Existing System to Redundancy

Introduction

If you are adding redundancy to an existing system, follow these guidelines:

- Changing the node number of a CNB module may affect messages, tags, or listen-only connections in other devices. Choose node numbers that have the least impact on existing communications.
- An existing system that contains local I/O modules still requires two additional chassis.
  - A redundant system can use only I/O that is in a remote chassis (for example, not in the same chassis as the controller).
  - We recommend that you move the existing 1756-L55Mxx controller from the original chassis and place it in a redundant chassis.
- Change any event tasks to periodic tasks. You can't use event tasks in a ControlLogix redundancy system.

Convert Local Modules to Remote Modules

If you are converting an existing system to a redundant system:

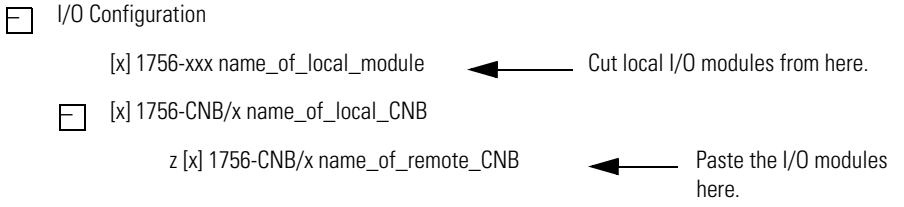
And the system	Then
Contained only I/O modules that were not in the same chassis as the controller	Do not change the I/O configuration of the controller.
Contained local I/O modules	Use the procedures in this section to convert the configuration of local modules to remote modules.

To convert a local module to a remote module:

- reconfigure the local I/O modules.
- replace local I/O tags.
- replace any aliases to local I/O tags.

Reconfigure the Local I/O Modules

1. If you have not already done so, add the CNB module of the remote chassis to the I/O configuration of the controller. See the *ControlLogix System User Manual*, publication 1756-UM001.

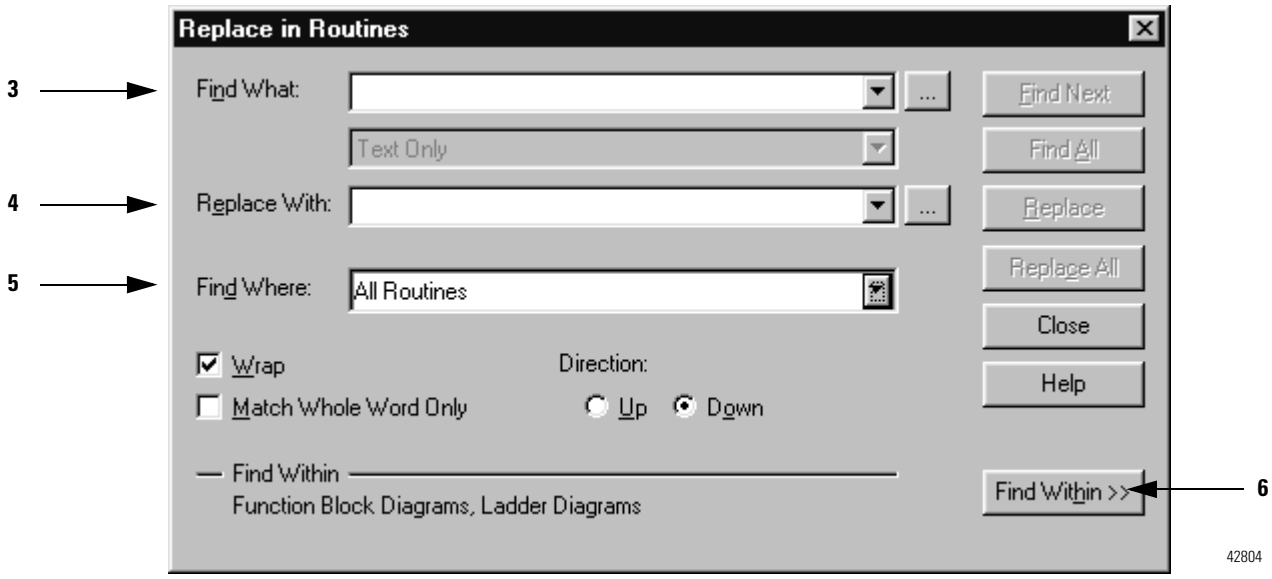


2. In the controller organizer, cut the modules from the local I/O configuration and paste them into the remote CNB module. Cut and paste the following modules:
   - I/O
   - 1756-DHRIO
   - 1756-DNB
   - 1756-ENET or -ENB
   - 1756-MVI

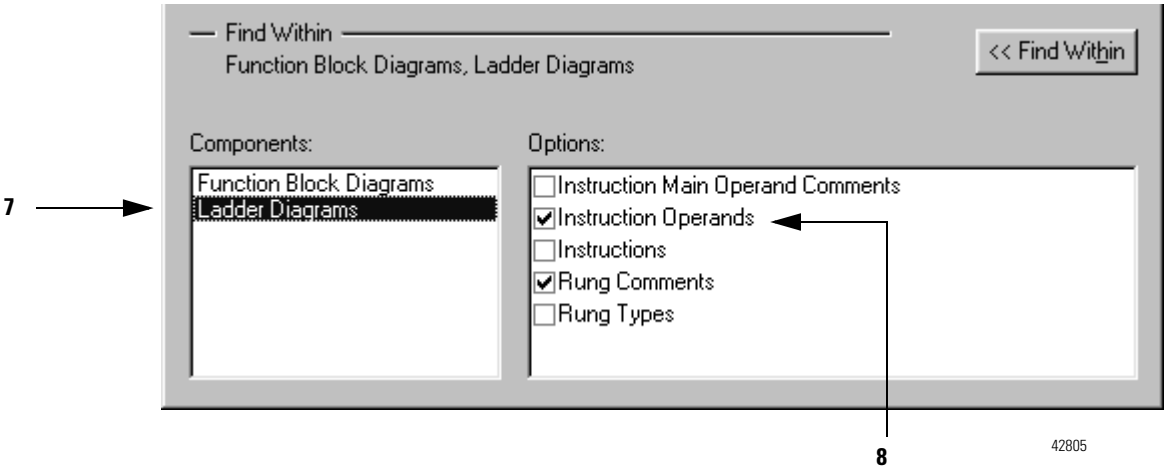
Replace Local I/O Tags

1. Open a routine. If a routine is already open, click within the routine to activate the window.

2. Press the *Ctrl* + *H* keys.



3. Type *Local*.
4. Type the name of the CNB module that is in the remote chassis.
5. Select *All Routines*.
6. Choose *Find Within* >>.



7. Select *Ladder Diagram*.
8. Check *Instruction Operands*.
9. Choose *Replace All*.

   The Search Results tab displays the changes to the logic.

10. Choose *Close*.

The following example shows the results of replacing “Local” with “chassis_c”.

EXAMPLE

```
Replacing "Local" with "chassis_c"...


Searching through MainProgram - MainRoutine...
Replaced: Rung 0, XIC, Operand 0: XIC(Local:16:I.Data.0)
Replaced: Rung 0, OTE, Operand 0: OTE(Local:2:O.Data.0)
Replaced: Rung 1, XIC, Operand 0: XIC(Local:16:I.Data.1)
Replaced: Rung 1, OTE, Operand 0: OTE(Local:2:O.Data.1)
Replaced: Rung 2, XIC, Operand 0: XIC(Local:16:I.Data.2)
Replaced: Rung 2, OTE, Operand 0: OTE(Local:2:O.Data.2)
Replaced: Rung 8, OTE, Operand 0: OTE(Local:15:O.CommandRegister.Run)


Complete - 7 occurrence(s) found, 7 occurrence(s) replaced.
```

Replace Any Aliases to Local I/O Tags

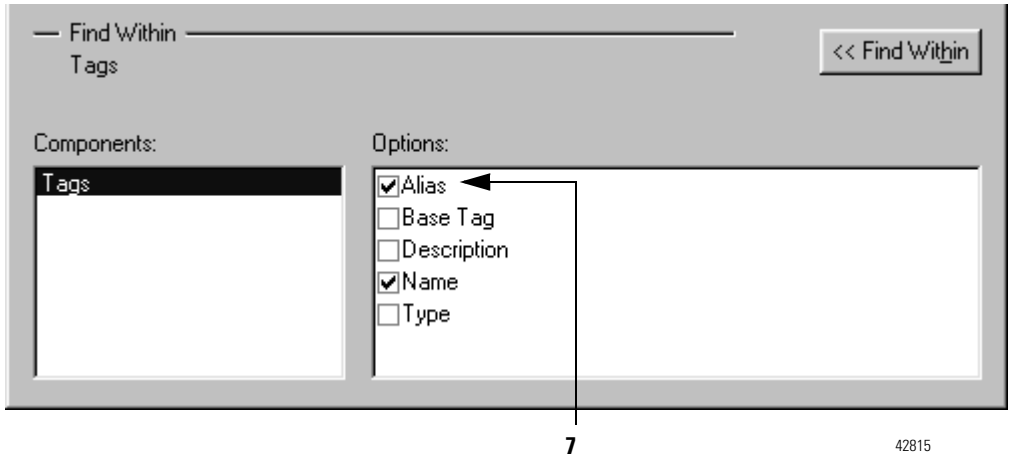
Are any tags aliases for I/O devices that were previously in a local chassis?

If	Then
Yes	Go to step 1.
No	Skip this procedure.

1. From the *Logic* menu, choose *Edit Tags*.

2. Press the *Ctrl* + *H* keys (replace).

3. Type *Local*.
4. Type the name of the CNB module that is in the remote chassis.
5. Select *All Tags*.
6. Choose *Find Within* >>.



7. Check *Alias*.
8. Choose *Replace All*.
9. Choose *Close*.

Notes:

Attributes of the Redundancy Object

Use the redundancy object to learn about the status of your redundancy system.

For this information	Get this attribute	Data type	GSV/SSV	Description	
Redundancy status of the entire chassis	ChassisRedundancy State	INT	GSV	**If**	**Then**
				16#1	Power up or undetermined
				16#2	Primary with synchronized secondary
				16#3	Primary with disqualified secondary
				16#4	Primary with no secondary
Redundancy state of the partner chassis	PartnerChassis RedundancyState	INT	GSV	**If**	**Then**
				16#8	Synchronized secondary
				16#9	Disqualified secondary with primary
				16#E	No partner
Redundancy status of the controller	ModuleRedundancy State	INT	GSV	**If**	**Then**
				16#1	Power up or undetermined
				16#2	Primary with synchronized secondary
				16#3	Primary with disqualified secondary
				16#4	Primary with no secondary
				16#6	Primary with synchronizing secondary
Redundancy state of the partner	PartnerModule RedundancyState	INT	GSV	**If**	**Then**
				16#7	Synchronizing secondary
				16#8	Synchronized secondary
				16#9	Disqualified secondary with primary
				16#E	No partner
Results of the compatibility checks with the partner controller	CompatibilityResults	INT	GSV	**If**	**Then**
				0	Undetermined
				1	No compatible partner
				2	Fully compatible partner

For this information	Get this attribute	Data type	GSV/SSV	Description	
Status of the synchronization (qualification) process	Qualification InProgress	INT	GSV	**If**	**Then**
				-1	Synchronization (qualification) is not in progress.
				0	Unsupported
				1 - 99	For modules that can measure their completion percentage, the percent of synchronization (qualification) that is complete.
				50	For modules that *cannot* measure their completion percentage, synchronization (qualification) is in progress.
				100	Synchronization (qualification) is complete.
Keyswitch settings of the controller and its partner match or do not match	KeyswitchAlarm	DINT	GSV	**If**	**Then**
				0	One of the following: • The keyswitches match. • No partner is present.
				1	Keyswitches do not match
Position of the keyswitch of the partner	PartnerKeyswitch	DINT	GSV	**If**	**Then the keyswitch is in**
				0	Unknown
				1	RUN
				2	PROG
				3	REM
Status of the minor faults of the partner (if the ModuleRedundancyState indicates that a partner is present)	PartnerMinorFaults	DINT	GSV	**This bit**	**Means this minor fault**
				4	Problem with an instruction (program)
				6	Periodic task overlap (watchdog)
				9	Problem with the serial port
				10	Low battery

For this information	Get this attribute	Data type	GSV/SSV	Description	
Mode of the partner	PartnerMode	DINT	GSV	**If**	**Then**
				16#0	Power up
				16#1	Program
				16#2	Run
				16#3	Test
				16#4	Faulted
				16#5	Run-to-program
				16#6	Test-to-program
				16#7	Program-to-run
				16#8	Test-to-run
				16#9	Run-to-test
				16#A	Program-to-test
				16#B	Into faulted
				16#C	Faulted-to-program
In a pair of redundant chassis, identification of a specific chassis without regard to the state of the chassis.	PhysicalChassisID	INT	GSV	**If**	**Then**
				0	Unknown
				1	Chassis A
				2	Chassis B

For this information	Get this attribute	Data type	GSV/SSV	Description
Slot number of the 1757-SRM module in this chassis	SRMSlotNumber	INT	GSV	
• Size of the last crossload • Size of the last crossload if you had a secondary chassis	LastDataTransfer Size	DINT	GSV	This attribute gives the size of data that was or would have been crossloaded in the last scan. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. Is there a synchronized secondary chassis? • Yes — This gives number of DINTs that was crossloaded in the last scan. • No — This gives number of DINTs that would have been crossloaded in the last scan.
• Size of the biggest crossload • Size of the biggest crossload if you had a secondary chassis	MaxDataTransfer Size	DINT	GSV SSV	This attribute gives the biggest size of the LastDataTransfer Size attribute. • The size in DINTs (4-byte words). • You must configure the controller for redundancy. • You don't need a secondary chassis. • To reset this value, use an SSV instruction with a Source value of 0. Is there a synchronized secondary chassis? • Yes — This gives biggest number of DINTs that was crossloaded. • No — This gives biggest number of DINTs that would have been crossloaded.

If You Have Series B ControlNet Bridge Modules

About This Appendix

This appendix describes several situations that could happen if you use series B of a ControlNet Bridge module:

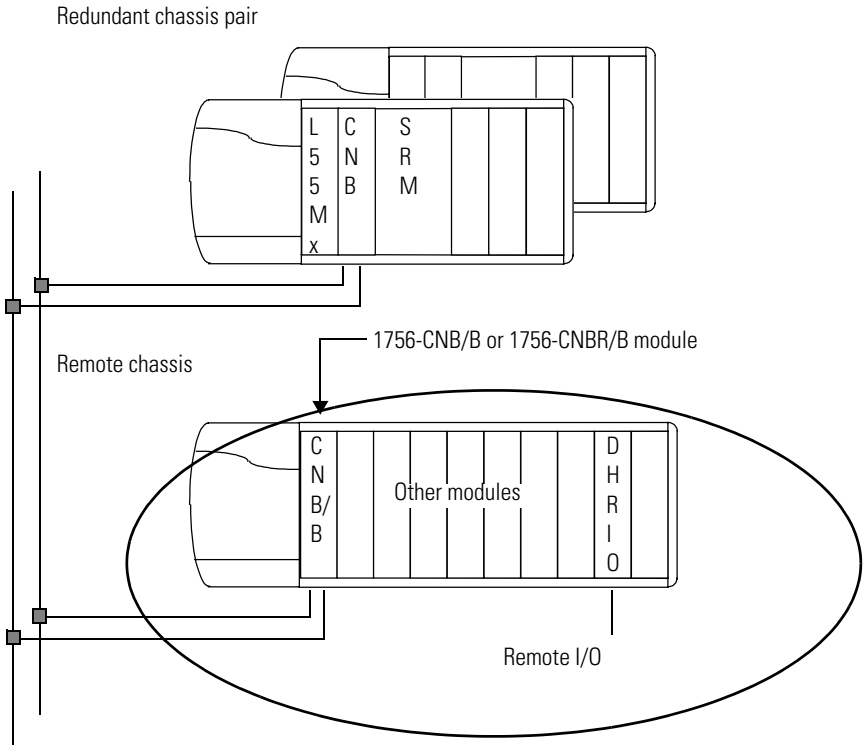
Topic	Page
Communication Loss If You Bridge Through a Series B ControlNet Bridge Module	175
Communication Could Stop If You Use a Series B ControlNet Bridge Module	177

Communication Loss if You Bridge Through a Series B ControlNet Bridge Module

Situation

You could temporarily lose communication with a remote chassis if you use both these modules in the remote chassis:

- 1756-CNB/B or 1756-CNBR/B module
- 1756-DHRIO module that is connected to a remote I/O network.



IMPORTANT On the first switchover after you download a project to the controller, you may temporarily lose communications with these devices

The loss of communication happens on the first switchover after you download the project to the redundant controller.

- You lose communication with the remote chassis and any devices to which you were bridging via the chassis, such as the remote I/O modules.
- During the communication loss, the I/O modules go to their configured state for a communication fault.
- The communication loss is temporary. Communications restore themselves.

Prevention

To prevent this situation, use series D ControlNet Bridge modules.

Communication Could Stop If You Use a Series B ControlNet Bridge Module

Situation

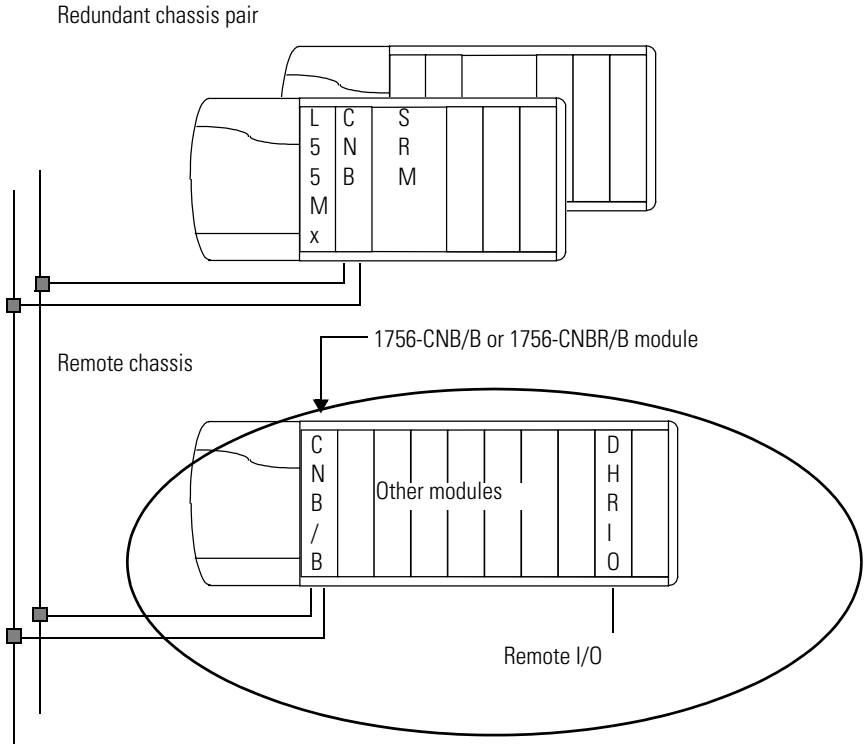
All communication on a ControlNet network could stop if the lowest node is a 1756-CNB/B or 1756-CNBR/B module. This happens if you unplug or break the tap of the module while it is turned on.

Corrective Action

If	Then
Tap of a series B ControlNet Bridge module becomes unplugged or broken.	1. Turn off the power to the module. 2. Replace the tap. 3. Turn on the power to the module.
Communication on the network stops because of an unplugged or broken tap.	Cycle power to each primary controller on the network.

Prevention

To prevent this situation, use series D ControlNet Bridge modules.

Restriction	Description
Communication Loss When Bridging Through a Series B ControlNet Bridge Module	You could temporarily lose communication with a remote chassis if you use both these modules in the chassis: • 1756-CNB/B or 1756-CNBR/B module • 1756-DHRIO module that is connected to a remote I/O network.  **IMPORTANT** On the first switchover after you download a project to the controller, you may temporarily lose communications with these devices The loss of communication occurs on the first switchover after you download the project to the redundant controller. • You lose communication with the remote chassis and any devices to which you were bridging via the chassis, such as the remote I/O modules. • During the communication loss, the I/O modules go to their configured state for a communication fault. • The communication loss is temporary. Communications restore themselves. To prevent this situation, use 1756-CNB/D/E or 1756-CNBR/D/E modules.

Restriction	Description
If the Lowest Node Is a 1756-CNB/B or -CNBR/B Module, Removing a Tap or Breaking a Cable Could Stop All Communications over the Network	If the lowest node on a ControlNet network is a 1756-CNB/B or 1756-CNBR/B module, all communications over the network could stop if: • a tap to the 1756-CNB/B or -CNBR/B module is disconnected or breaks and then is replaced while power is still applied to the 1756-CNB/B or -CNBR/B module If a tap to a 1756-CNB/B or -CNBR/B module becomes disconnected or broken, take these actions: 1. Turn off the power to the 1756-CNB/B or -CNBR/B module. 2. Replace the tap. If a communication failure occurs because of a disconnected or broken tap, cycle power to each primary controller on the network. To prevent this situation, use a 1756-CNB/D/E or -CNBR/D/E module as your lowest node on the network.

Notes:

Redundant System Restrictions

Proper Use of an EtherNet/IP Network

For EtherNet/IP communication and messaging, keep the following restrictions in mind:

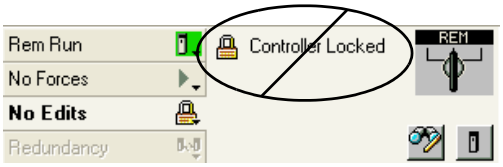
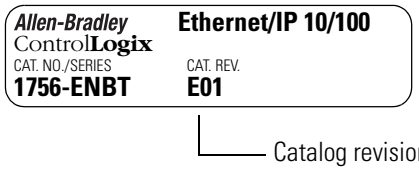
IMPORTANT In a redundant system, use an EtherNet/IP network only for HMI/workstation communication and messaging.

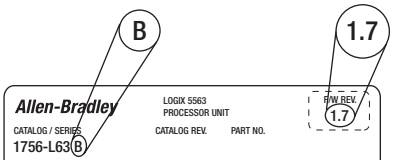
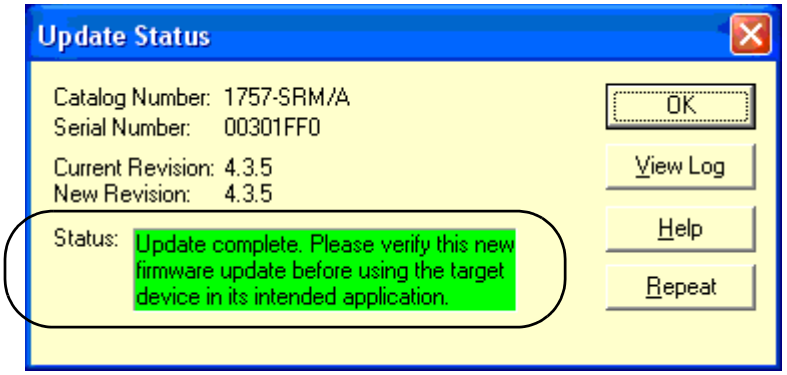
Do not use an EtherNet/IP network for:

- communication with I/O modules.
- communication between devices via produced/consumed tags.

Restriction	Details
Don't use ControlLogix5564 controllers.	You can't use this revision with 1756-L64 controllers.
Don't use 1756-CN2 modules in a redundant chassis.	You can't use this revision with 1756-CN2 ControlNet bridge modules in a redundant chassis.
Don't use equipment phases.	This revision won't let you download a project that has equipment phases or create equipment phases online.
Don't use this revision to update a revision 11 or earlier system.	Use this revision only if your redundant chassis are already updated to revision 13 or aren't in operation yet
Don't use the nonvolatile memory of a ControlLogix5555 controller.	Don't use the nonvolatile memory of a 1756-L55M2x controller. This includes storing a project to nonvolatile memory and loading it from nonvolatile memory. Otherwise the controller will have an unrecoverable fault (solid red OK light) and clear the project from its memory.

Lgx00068091

Restriction	Details
Always keep the controller unlocked.	Make sure the controller stays unlocked. **Don't** lock the controller.  A redundancy system automatically unlocks a locked controller during a switchover. But the workstation that locked the controller doesn't show the change. The workstation continues to show that the controller is locked even though it isn't. Once the controller is unlocked, multiple workstations can edit the project in the controller. Lgx00067869
Revision 2.6 or later of the SRM configuration tool doesn't work with revision 11 or earlier systems.	Revision 2.6 or later of the 1757-SRM System Redundancy Module Configuration tool doesn't work with revision 11 or earlier redundancy systems. You can cause the 1757-SRM module to fault. • Use revision 2.6 or later of the configuration tool only with revision 13 or later ControlLogix redundancy systems. • RSLinx software version 2.43 or later automatically installs version 2.6 or later of the configuration tool. • To connect to a revision 11 or earlier redundancy system, uninstall the configuration tool and install a compatible version. Use version 2.5 of the configuration tool for revision 11 redundancy systems.
Make sure your ENBT modules are catalog revision E01 or later.	To use a 1756-ENBT module in a redundant controller chassis, make sure its catalog revision is E01 or later. Otherwise, the secondary chassis won't synchronize with the primary chassis.  To find the catalog revision of a module, look at the label on the side of the module or box. **Example:** Use a catalog revision, such as E01, E02, or F01.

Restriction	Details
For a series B controller with 1.7 firmware, use a nonredundant chassis to update it the first time.	Example You just took the controller out of its box. Its label shows that it is a series B controller with 1.7 firmware, as in the following example:.  In this case: 1. Put the controller in a nonredundant chassis. 2. Update the controller. 3. Put the controller in the redundant chassis. Otherwise, the controller will have a an unrecoverable fault. After you update it the first time, you can update it in the redundant chassis from then on. Nonexample The controller is already running in your system. You want to update it to a later revision. In this case, leave it where it is and update it there.
Give an SRM module several minutes or more to update.	It takes several minutes to update a 1757-SRM module and the module resets itself at least 4 times. An SRM module with 3.37 or earlier firmware may become inoperative if you interrupt the update process. Wait until you see this box turn green and say Update complete.  If the update fails, leave the power on and try again. The update failed if you see: • Update Status window turn red and say the update failed. • OK LED on the SRM module is red flashing and the 4-character display is blank.
Wait at least 45 seconds after the redundant chassis are disqualified before you try to synchronize them	If your secondary chassis becomes disqualified or you manually disqualify it, do these actions before you try to synchronize the chassis: • Make sure the synchronization status of the primary modules is full compatibility. • Wait at least 45 seconds before you give the command to synchronize the secondary chassis.

Restriction	Details
If you unplug the fiber optic cable between the SRM modules, wait until they stabilize before you reconnect it	If you unplug the fiber optic cable between the 1757-SRM modules, check the synchronization status of the secondary SRM module before you reconnect the cable. Wait until its status is secondary with no partner. You can reconnect the cable once the module is in that state. Otherwise, the secondary SRM could fault with EA91 error.

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